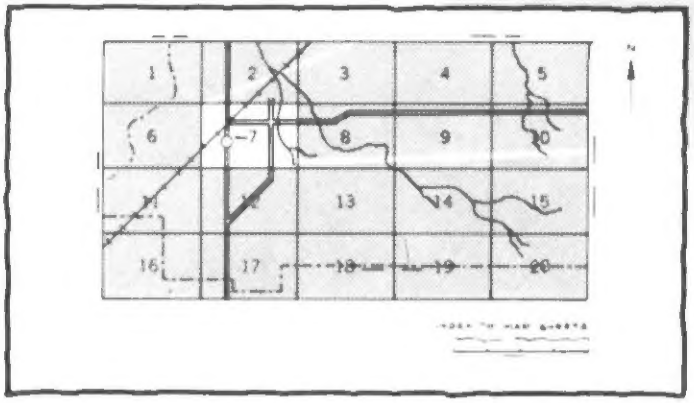
Soil survey of

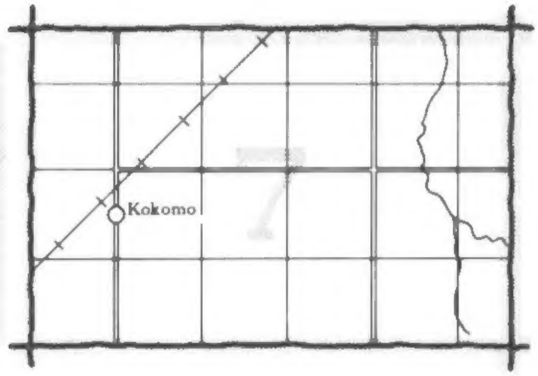
Dubois County, Indiana

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Purdue University Agricultural Experiment Station and
Indiana Department of Natural Resources
Soil and Water Conservation Committee

HOW TO USE

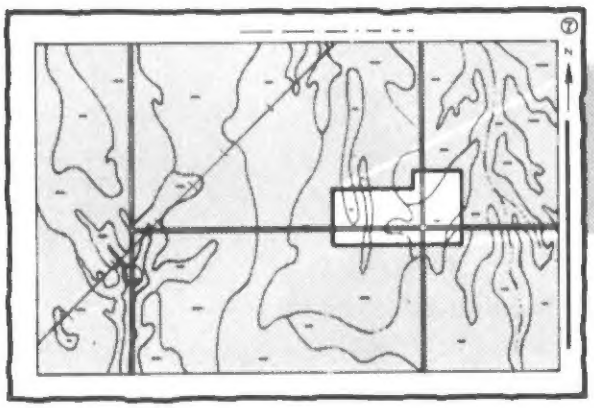
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

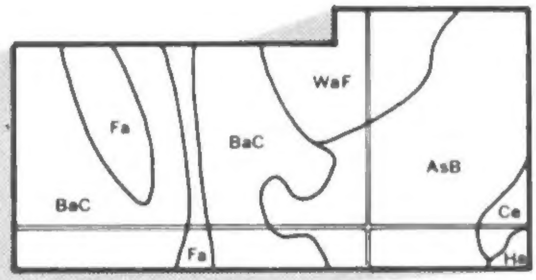




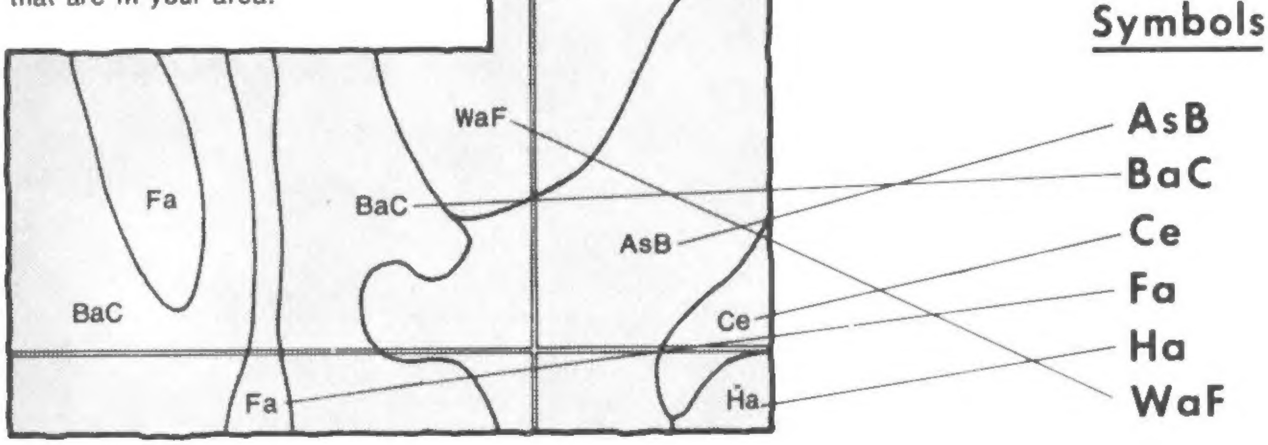
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



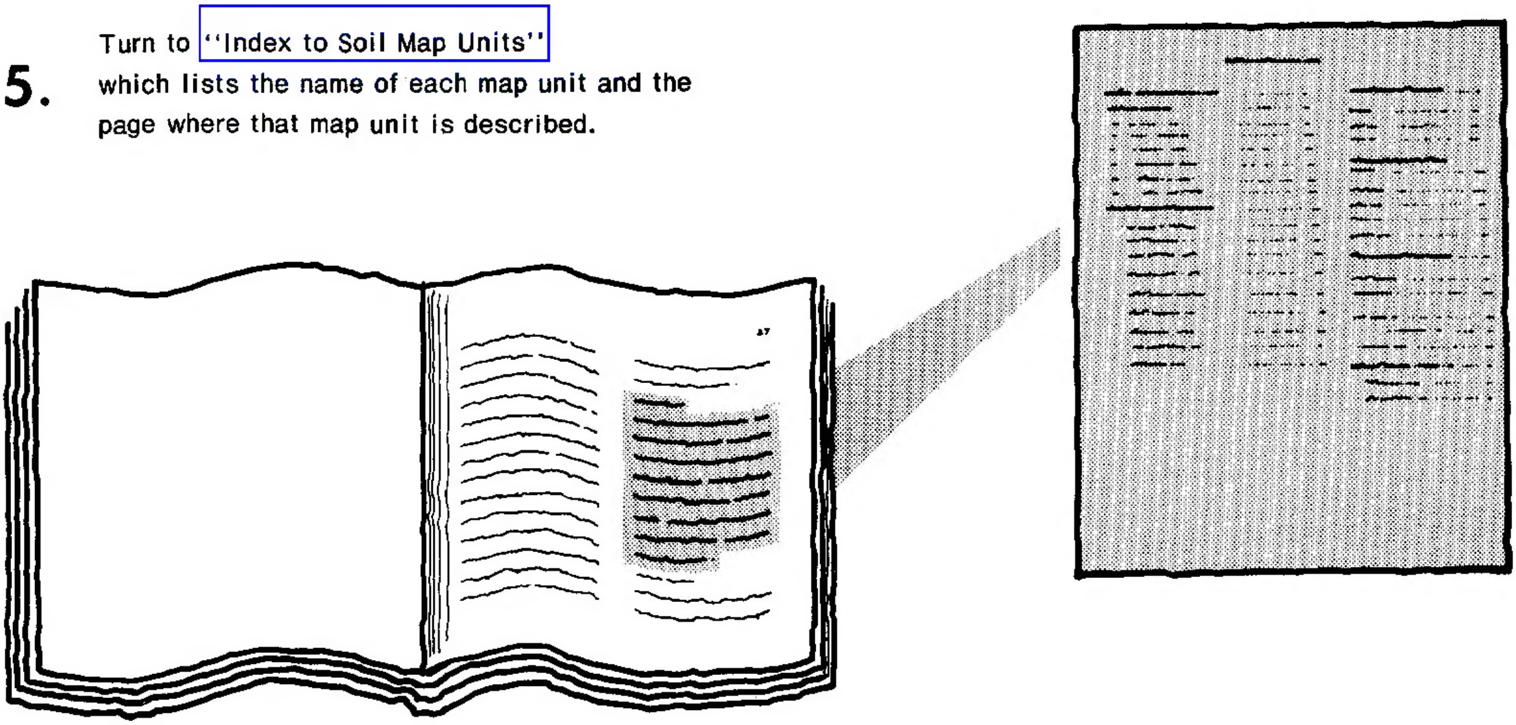


4. List the map unit symbols that are in your area.

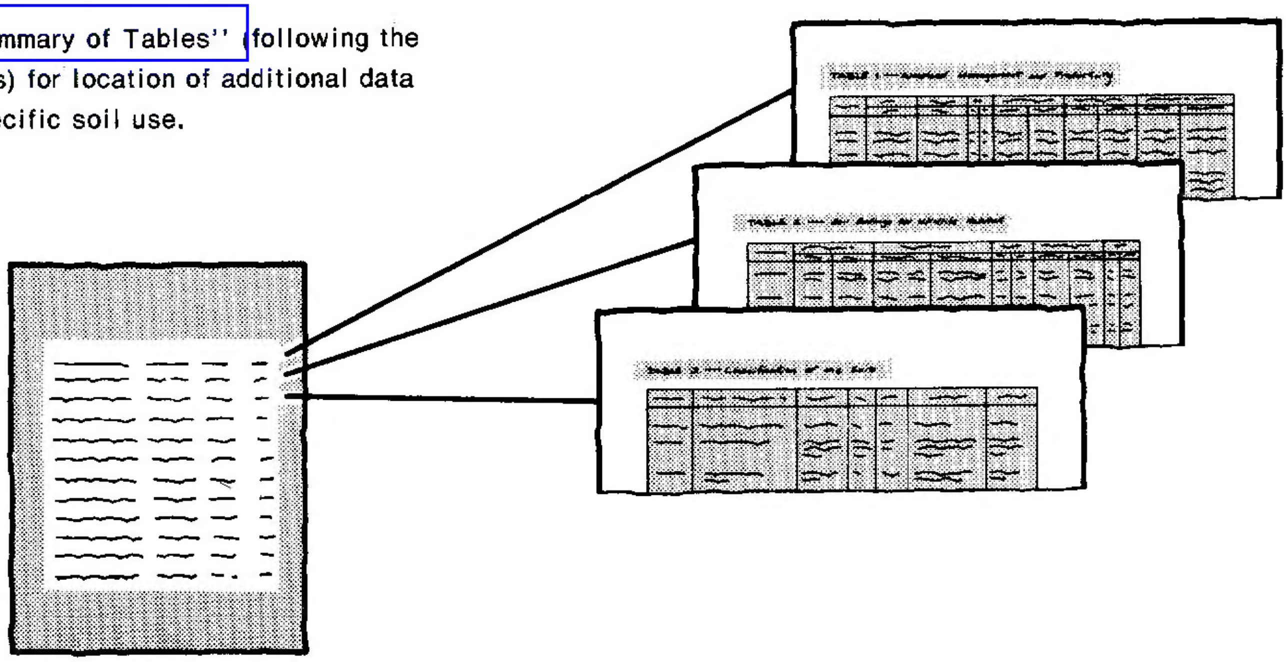


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1973-1977. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977.

This survey was made cooperatively by the Soil Conservation Service, Purdue University Agricultural Experiment Station and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Dubois County Soil and Water Conservation District. Financial assistance was made available by the Dubois County Board of County Commissioners.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Fescue and timothy hayfield on Zanesville silt loam, 6 to 12 percent slopes, eroded. Corn in background is on Tilsit silt loam, 2 to 6 percent slopes, and Zanesville silt loam, 6 to 12 percent slopes, eroded.

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Issued February 1980

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Foreword

This soil survey contains information that can be used in land-planning programs in Dubois County, Indiana. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

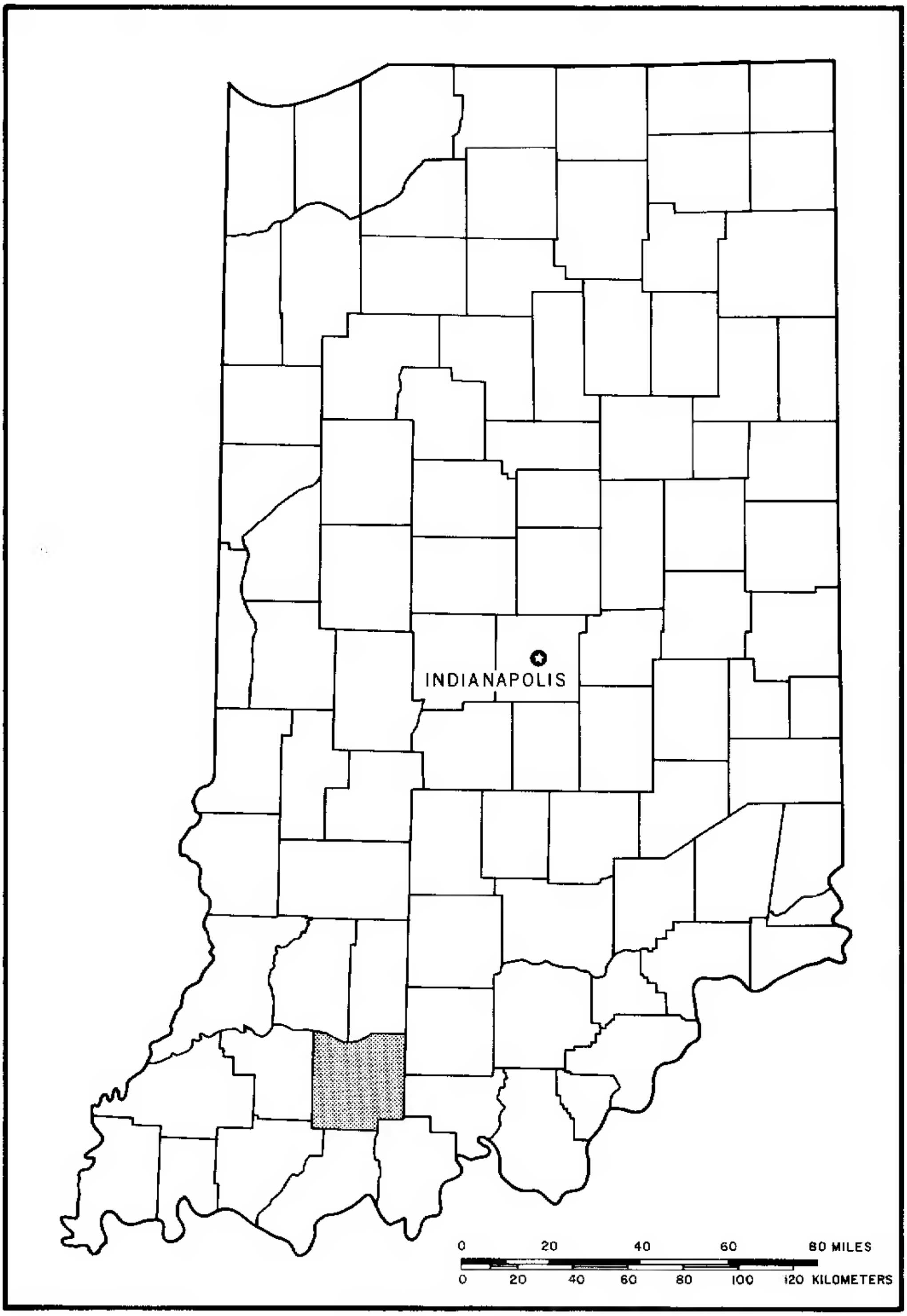
This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Buell M. Ferguson

Buell M. Ferguson
State Conservationist
Soil Conservation Service



Location of Dubois County in Indiana.

SOIL SURVEY OF DUBOIS COUNTY, INDIANA

By Robert C. Wingard, Jr., Soil Conservation Service

Soils surveyed by Robert C. Wingard, Jr., and John R. Bernard, Soil Conservation Service, and Jack W. Coulter and Gary L. Hudson, Soil and Water Conservation Committee, Indiana Department of Natural Resources

United States Department of Agriculture, Soil Conservation Service, in cooperation with Purdue University Agricultural Experiment Station and Indiana Department of Natural Resources, Soil and Water Conservation Committee

DUBOIS COUNTY is in the southwestern part of Indiana. It has a total area of 277,120 acres, or 433 square miles. The county extends about 21 miles from north to south and about 21 miles from west to east. Jasper, the county seat, is near the center of the county. The population of the county is about 30,934 according to the 1970 census data.

The first soil survey of Dubois County was published in 1937 (*5*). This survey updates the first survey and provides additional information and larger maps that show the soils in greater detail.

The physiography of Dubois County is made up of broad terraces and bottom lands in the northwestern part of the county and nearly level to very steep uplands in the remaining part. The county is drained by many small streams that empty into the Patoka River, the East Fork of White River, and the Anderson River. Elevation of the land ranges from about 430 feet to about 810 feet above sea level.

The main sources of income in the county are agriculture and wood products industries. Corn, soybeans, and wheat are the major crops, and hogs and poultry are the major types of livestock. There are also large numbers of beef cattle and some dairy cattle.

General nature of the county

This section gives general information concerning the county. It discusses settlement, natural resources, farming, and climate.

Settlement of the county

Dubois County was named in honor of Toussaint Dubois, a Frenchman of Vincennes, Indiana. He was a soldier under General William Henry Harrison's command in the Tippecanoe campaign in 1811. The present Dubois County was organized as a separate county on December 20, 1817. In 1818, part of the county was annexed to Perry County, and, in 1820, Martin County was organized out of Daviess and Dubois Counties, thus reducing Dubois County to about its present boundaries.

It is generally believed that the county was settled in 1801 along a route that passed through the county and led from Vincennes to Jeffersonville. The route was known as the "Buffalo Trace" because of the mud holes, which rendered it almost impassable. At one time, the trail was known locally as the "Mud Hole Trace." It passed south of Portersville and almost parallel to the base line.

The original county seat was located at Portersville and remained there until 1829-1830, when the seat of justice was moved to its present location at Jasper. The move was made partly because the land was donated and partly because the population was rapidly increasing in the central part of the county. The new location proved to be a thriving center for trade and business enterprises.

Natural resources

Soil is the most important natural resource in the county. The crops produced and the livestock raised for meat are marketable products that are derived from the soil. Also, with a large part of the county in woodland, timber is an important marketable product derived from the soil.

Most of the county has low potential as a source of underground water. In many places, not enough water can be obtained from drilled wells for domestic and farm use. The quality of water from drilled wells varies greatly. In many wells the water is not suitable for drinking. Most of the water supply is stored in reservoirs, lakes, and ponds, and many ponds have been built throughout the county.

A few, small coal strip mines are operating in the county. These are mainly in the southwestern part of the county.

Farming

Farming in Dubois County is based mainly on raising grain and livestock, mainly hogs and cattle and poultry.

Corn, soybeans, and wheat are the main crops grown in the county. Meadow crops provide hay and pasture for livestock. Most pastures are a mixture of timothy, fescue, alfalfa, and red clover.

According to the Census of Agriculture, between 1964 and 1974 the number of farms decreased from 1,326 to 1,129, a decrease of 197 farms in 10 years. The average size of farms increased from 165.3 acres in 1964 to 186 acres in 1974.

Full owners of farms have decreased in number from 1,001 in 1964 to 836 in 1974. The number of part owners have decreased from 253 in 1964 to 234 in 1974. Tenancy decreased from 69 in 1964 to 59 in 1974.

In 1974, 81 percent of the farm income from agricultural products came from the sale of livestock, and poultry and their products. The numbers of cattle, hogs, and poultry increased from 1964 to 1974.

Climate

In Dubois County, summers are hot in valleys and slightly cooler in the hills; winters are moderately cold. Rains are fairly heavy and well distributed throughout the year. Snow falls nearly every winter, but the snow cover usually lasts only a few days.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Paoli, Indiana, for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 32 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Paoli on January 28, 1963, is -27 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred on July 15, 1954, is 107 degrees.

Growing degree days, shown in table 1, are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 24 inches, or 55 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 5.73 inches at Paoli on July 21, 1973. Thunderstorms occur on about 45 days each year, and most are in summer.

Average seasonal snowfall is 17 inches. The greatest depth of snow at any one time during the period of record was 12 inches. On the average, 3 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The percentage of possible sunshine is 75 in summer and 45 in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 10 miles per hour, in March.

Climatic data for this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management

are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows the dominant soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used. The ratings for potential are averages of the potential ratings for individual map units.

Each map unit is rated for *cultivated crops, pasture and hayland, woodland, urban uses,* and *recreation areas.* Cultivated crops are those grown extensively in the survey area. Pasture and hayland refers to land being used for the pasture of livestock or the production of hay. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic. Extensive recreation areas are those used for nature study and as wilderness.

The names, descriptions, and delineations of soils on the general soil map of this county do not always agree or join fully with those of adjoining counties published at an earlier date. This difference is due to changes in concepts of soil series in the application of the soil classifications system. Other differences are brought about by a different predominance of soils in map units made up by two or three series. Still other differences may be caused by the range in slope allowed within the map unit of adjoining surveys. In this county or in adjacent counties a map unit is sometimes too small to be delineated.

Descriptions and potentials of map units

1. Gilpin-Zanesville-Berks

Moderately deep and deep, moderately sloping to very steep, well drained soils; on uplands

This map unit makes up about 28 percent of the county. It is about 50 percent Gilpin soils, 15 percent Zanesville soils, 9 percent Berks soils, and 26 percent soils of minor extent (fig. 1).

Moderately deep Gilpin soils are strongly sloping to very steep and are on side slopes. The deep Zanesville soils are moderately sloping and are on ridgetops and upper parts of side slopes. The moderately deep Berks soils are steep to very steep and are on side slopes. All of these soils are along drainageways. The Gilpin and Zanesville soils have a silt loam surface layer and the Berks soils have a channery silt loam surface layer.

The minor soils in the map unit are the well drained Wellston, Cuba, and Burnside soils; the moderately well drained Tilsit soils; and the somewhat poorly drained Stendal soils. The Wellston and Tilsit soils are on ridgetops and upper parts of side slopes adjacent to drainageways. The Cuba, Burnside, and Stendal soils are on bottom lands along streams and drainageways.

These soils are used mainly for hay and pasture and for woods. The steep slopes and the hazard of erosion are the main limitations in the use of these soils for farming and for most other purposes.

These soils have poor potential for cultivated farm crops. The soils have fair potential for hay and pasture because of the strong slopes. The potential for woodland is good. The soils have poor potential for sanitary facilities and building site developments because of the strong slopes and depth to rock and for intensive recreation because of the strong slopes.

2. Zanesville-Gilpin-Tilsit

Deep and moderately deep, nearly level to moderately steep, well drained and moderately well drained soils; on uplands

This map unit makes up about 44 percent of the county. It is about 30 percent Zanesville soils, 28 percent Gilpin soils, 16 percent Tilsit soils, and 26 percent soils of minor extent.

The well drained Zanesville soils are moderately slop-

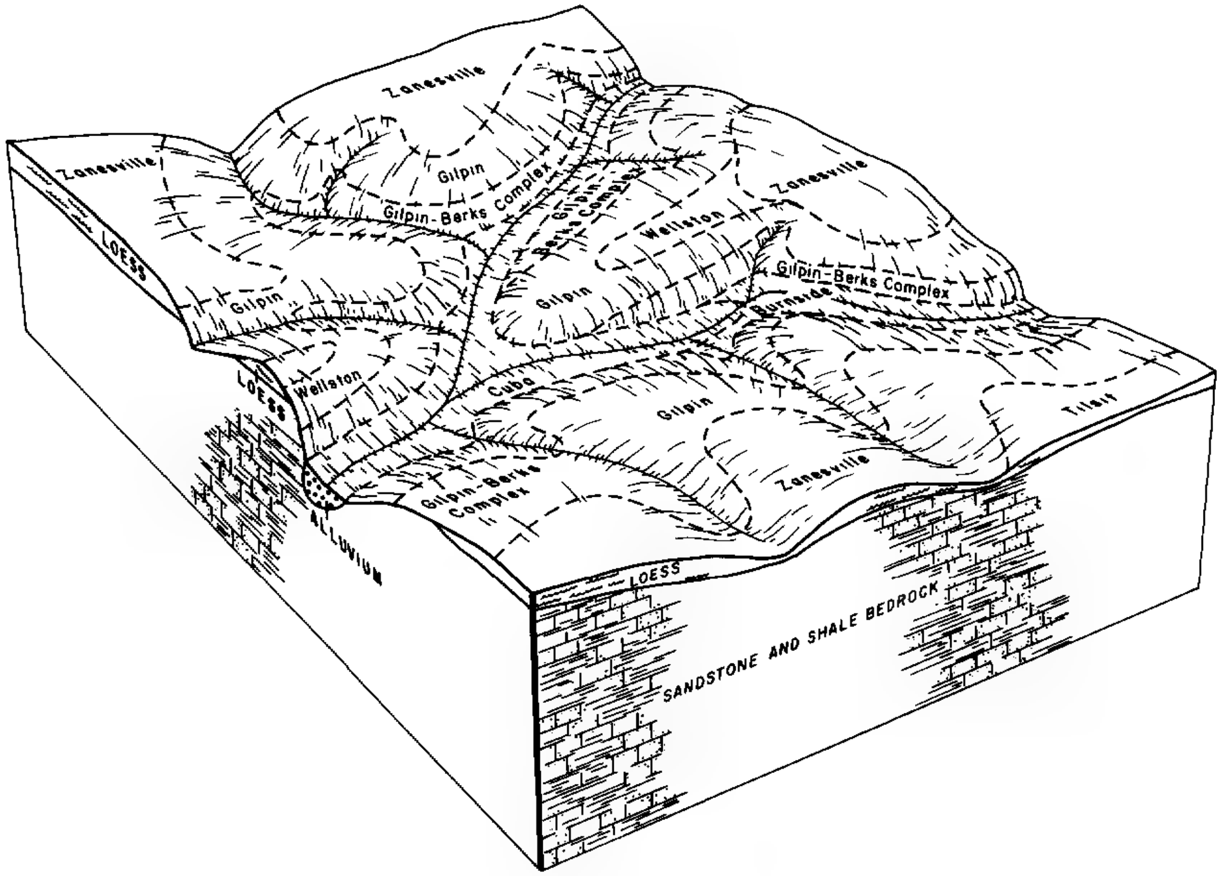


Figure 1.—Pattern of soils and underlying material in the Gilpin-Zanesville-Berks map unit.

ing and are on ridgetops and upper parts of side slopes adjacent to drainageways. The well drained Gilpin soils are strongly sloping to moderately steep and are on hillsides adjacent to drainageways. The moderately well drained Tilsit soils are nearly level and gently sloping and are on ridgetops. All of these soils have a silt loam surface layer. The Zanesville and Tilsit soils have a seasonal high water table.

The minor soils in the map unit are the well drained Berks and Wellston soils, the somewhat poorly drained Stendal soils, and the poorly drained Bonnie soils. The Berks soils are on the steep and very steep side slopes adjacent to drainageways. The Wellston soils are on narrow ridgetops. The Bonnie and Stendal soils are on bottom lands along streams and drainageways.

These soils are used mainly for hay and pasture, but some tracts are used for cultivated crops. Some areas have not been cleared and remain in woodland. The erosion hazard is a limitation in the use of these soils for farming and most other purposes.

These soils have fair potential for cultivated farm crops. The soils on the ridgetops are suited to cropping; however, those on the side slopes should not be cropped because of the erosion hazard. The potential is good for pasture and hayland and for woodland. These soils have fair potential for sanitary facilities and building site developments because of the strong slopes, very slow or slow permeability, or the seasonal high water table in the winter and spring months. These soils have fair potential for intensive recreation areas because of wetness on the ridgetops and because of the strong slopes.

3. Stendal-Steff-Cuba

Deep, nearly level, somewhat poorly drained to well drained soils; on floodplains

This map unit makes up about 14 percent of the county. It is about 45 percent Stendal soils, 18 percent Steff soils, 10 percent Cuba soils, and 27 percent soils of minor extent.

The somewhat poorly drained Stendal soils are adjacent to the hillsides and are on the broad flats along streams and drainageways. The moderately well drained Steff soils are along streams and are slightly higher than the Stendal soils. The well drained Cuba soils are along the streams. All of these soils have a silt loam surface layer; Steff and Stendal soils have a seasonal high water table.

The minor soils in the map unit are the well drained Burnside, Chagrin, and Nolin soils; the moderately well drained Pekin soils; the somewhat poorly drained Bartle and McGary soils; the poorly drained Bonnie, Peoga, and Petrolia soils; and the very poorly drained Montgomery soils. The Bartle, Peoga, and Pekin soils are on the low terraces adjacent to the bottom lands. The Burnside soils are on the narrow bottom lands along the drainageways that empty into the main streams. The McGary and Montgomery soils are on terraces along streams and drainageways that empty into the White River. The Chagrin, Nolin, and Petrolia soils are on the bottom lands adjacent to the White River.

These soils are used mainly for cultivated crops. Some areas are used for hay and pasture, and some are woodland. Wetness and the hazard of flooding are the main limitations in the use of these soils for farming and for most other purposes. A large part of these soils needs artificial drainage. Some of the soils have been drained.

These soils have good potential for cultivated farm crops and hayland and pasture, when adequately drained. The soils have good potential for woodland. They have poor potential for sanitary facilities and building site developments because of flooding and a seasonal high water table in a large part of the unit. The potential for intensive recreation areas is fair because of wetness and the flooding hazard.

4. Otwell-Dubois-Peoga

Deep, nearly level to moderately sloping, well drained to poorly drained soils; on lake plains and terraces

This map unit makes up about 11 percent of the county. It is about 40 percent Otwell soils, 16 percent Dubois soils, 12 percent Peoga soils, and 32 percent soils of minor extent (fig. 2).

The moderately well drained or well drained Otwell soils are nearly level to moderately sloping and are on areas adjacent to drainageways. The somewhat poorly

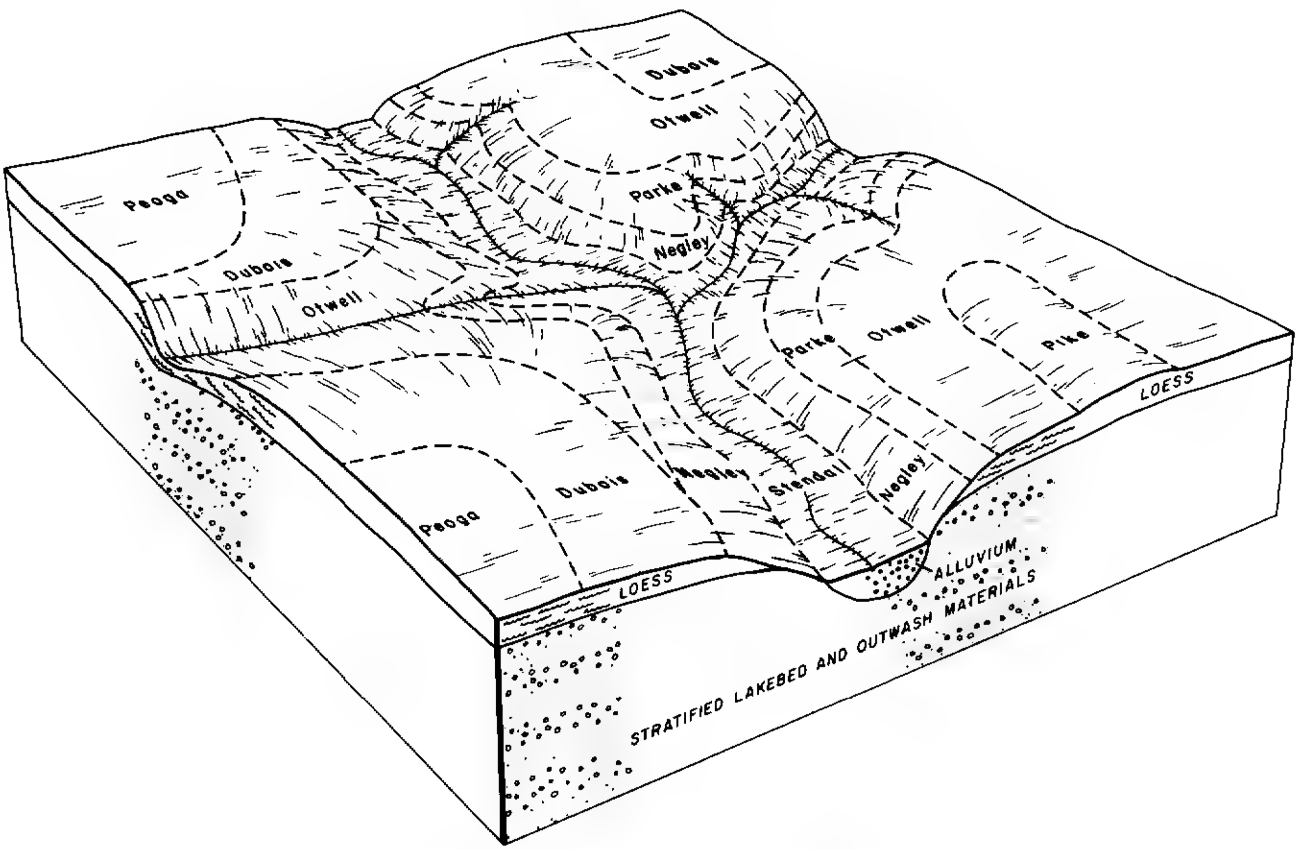


Figure 2.—Pattern of soils and underlying material in the Otwell-Dubois-Peoga map unit.

drained Dubois soils are nearly level and gently sloping and are on areas between drainageways. The poorly drained Peoga soils are nearly level and are in depressional areas on broad flats. All of these soils have a silt loam surface layer. The Dubois and Peoga soils have a seasonal high water table.

The minor soils in the map unit are the well drained Parke, Pike, and Negley soils; the somewhat poorly drained Stendal soils; and the poorly drained Bonnie soils. The Parke, Pike, and Negley soils are on the side slopes and flats adjacent to the drainageways. The Stendal and Bonnie soils are along the streams and drainageways.

The soils are used mainly for cultivated crops. Some areas are used for hay and pasture, and a few small areas are woodland. Wetness is the main limitation in the use of these soils for farming and for most other purposes.

These soils have good to fair potential for cultivated farm crops and good potential for pasture and hayland, if adequately drained. They have potential for woodland. The soils have fair potential for sanitary facilities and building site developments, because they are limited by wetness. Adequate drainage must first be considered for areas of this unit if they are to be used for urban development. The potential for intensive recreation areas is fair because wetness is a limitation of the soils.

5. Pike-Negley-Parke

Deep, nearly level to very steep, well drained soils; on lake plains and outwash terraces

This soil map unit makes up about 2 percent of the county. It is about 31 percent Pike soils, 24 percent Negley soils, 17 percent Parke soils, and 28 percent soils of minor extent.

Pike soils are on slightly convex flats and on low, rolling ridges. Negley soils are on the steeper side slopes and ridges around drainageways. All of these soils have a silt loam or a loam surface layer.

The minor soils in this map unit are the moderately well drained and well drained Otwell soils, the somewhat poorly drained Dubois and Stendal soils, and the poorly drained Peoga soils. The Otwell soils are on low ridges in the flat areas. The Dubois soils are on slightly raised parts of the flats and on the tops of broad ridges. The Stendal soils are along the streams and drainageways. The Peoga soils are in depressional areas on the broader flats.

These soils are used mainly for cultivated crops and hay and pasture. The erosion hazard is the main limitation of these soils for farming and for most other purposes.

These soils have fair potential for cultivated farm crops. A large part of the soils in the unit are suited to cropping; however, those on the more sloping side slopes should not be cropped because of the erosion hazard. The soils have good potential for pasture and hayland and for woodland. They have fair potential for sanitary facilities and building site developments because of the strong slopes in some areas. The slope should be the prime consideration if areas are to be used for urban development. The potential for intensive recreation areas is fair, because slopes are the limiting factor.

6. Alford-Princeton

Deep, gently sloping to very steep, well drained soils; on uplands

This map unit makes up about 1 percent of the county. It is about 44 percent Alford soils, 34 percent Princeton soils, and 22 percent soils of minor extent.

The Alford soils are gently sloping on the ridgetops and moderately sloping to very steep on side slopes. The Princeton soils are gently sloping and moderately sloping on the ridgetops and strongly sloping to very steep on side slopes. They are mainly nearer the river than the Alford soils are. The Alford soils have a silt loam surface layer, and the Princeton soils have a surface layer of loamy fine sand.

The minor soils in this map unit are the well drained Berks, Gilpin, Negley, and Parke soils; the moderately well drained and well drained Otwell soils; the somewhat poorly drained Stendal soils; and the poorly drained Petrolia soils. The steeper Berks and Gilpin soils are on side slopes adjacent to the bottom lands. The Parke and Negley soils are on side slopes along drainageways and sharp breaks on the adjoining lake plains. The Otwell soils are on low ridges in flat areas and around the heads of drainageways. Stendal and Petrolia soils are on the adjacent bottom lands.

These soils are used mainly for hay and pasture. Some tracts are used for cultivated crops, and some areas are woodland. The erosion hazard is the major limitation in the use of these soils for farming and for most other purposes.

These soils have fair potential for cultivated farm crops. The less sloping soils of the unit are suited to cropping; however, the stronger sloping soils on hillsides should not be cropped because of the erosion hazard. These soils have good potential for pasture and hay and for woodland. They have fair potential for sanitary facilities and building site developments because of the strong slopes in some areas. The slope should be the prime consideration if areas are to be used for urban development. The potential for intensive recreation areas is fair, because slopes are the limiting factor.

Broad land-use considerations

It is necessary to identify the soils in the survey area that are best suited to different specified uses. The general soil map is helpful for broad planning of the county; however, it cannot be used for the selection of sites for

specific uses. The data about specific soils in this survey area can be found in "Soil maps for detailed planning" and is helpful in planning future land-use patterns.

The nearly level and gently sloping soils of the Pike-Negley-Parke, the Alford-Princeton, and the Zanesville-Gilpin-Tilsit map units have good potential for cultivated farm crops. The more sloping soils of these units have fair to poor potential for cultivated farm crops. Most of the steeper soils should not be cultivated because the erosion hazard is severe. The Stendal-Steff-Cuba map unit has good potential for cultivated crops. Flooding is a hazard on the soils in this unit. Wetness is a limitation of the Stendal part of this unit; however, many farmers have provided sufficient drainage to grow cultivated crops. The Otwell-Dubois-Peoga map unit has good to fair potential for cultivated crops. Wetness is a limitation of the Dubois and Peoga parts of this unit; however, many farmers have provided sufficient drainage to grow crops.

Most soils in the county have good potential for pasture and hayland with the exception of part of the Gilpin-Zanesville-Berks map unit, where management is difficult because of the strongly sloping soils and the rock outcrops. Wetness is a limitation on parts of the Otwell-Dubois-Peoga and Stendal-Steff-Cuba map units. Water-tolerant grasses and legumes should be favored in these areas. Part of the Zanesville-Gilpin-Tilsit map unit is not suited to deep rooted legumes because the soils have a fragipan in the subsoil.

Most of the soils in the county have good to fair potential for woodland. Commercially valuable trees are less common and generally do not grow as rapidly on the wetter soils of the Otwell-Dubois-Peoga map unit as on other soils. Also, trees do not grow as rapidly on the fragipan soils of the Otwell-Dubois-Peoga, Zanesville-Gilpin-Tilsit, and the Gilpin-Zanesville-Berks map units.

Many of the soils in the county have poor potential for urban development. In the Gilpin-Zanesville-Berks, Zanesville-Gilpin-Tilsit, and Otwell-Dubois-Peoga map units, either strong slopes or a seasonal high water table are limitations to urban use. Also, depth to rock is a limitation in the Berks and Gilpin parts of the Zanesville-Gilpin-Tilsit and the Gilpin-Zanesville-Berks map units. In the Stendal-Steff-Cuba map unit, flooding is a hazard for urban development. Also, in the Stendal and Steff parts of the unit, the soils have a seasonal high water table. In the Pike-Negley-Parke and Alford-Princeton map units, the nearly level and gently sloping soils have a good potential for urban development; however, the strongly sloping to very steep soils have poor potential for these uses.

A large part of the soils in the county have poor potential for intensive recreation areas, such as campsites and picnic areas, because of the strong slopes or seasonal high water table. The nearly level and gently sloping soils of the Pike-Negley-Parke and the Alford-Princeton map units have a good potential for intensive recreation areas. A large part of the county has good potential for extensive recreational areas, such as hiking trails and nature study parks. Hardwood forests add to the beauty of much of the county.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Gilpin silt loam, 12 to 18 percent slopes, eroded, is one of several phases in the Gilpin series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Gilpin-Berks complex, 20 to 50 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

AfB—Alford silt loam, 2 to 6 percent slopes. This gently sloping soil is deep and well drained. This soil is on loess-covered uplands. It is on broad ridgetops, long side slopes, and toe slopes. Individual areas are irregularly shaped and are dominantly 20 to 30 acres in size.

In a typical profile, the surface layer is brown silt loam about 7 inches thick. The subsurface layer is brown silt loam about 6 inches thick. The subsoil is about 42 inches thick. The upper part is strong brown, firm silty clay loam, and the lower part is strong brown and brown, firm and friable silt loam. The underlying material, to a depth of 60 inches, is brown, silt loam. There are a few areas of a similar soil that has slopes of about 0 to 2 percent.

Included with this soil in mapping are a few small areas of moderately sloping Alford soils on side slopes around the drainageways. Also included are a few small areas of well drained Princeton soils that are on hummocky slopes that finger into areas of Alford soils. Small areas of wet soils are in the bottom of the drainageways. These inclusions make up about 5 to 10 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easy to till.

Most of this soil is used for growing corn, soybeans, and small grain. Some areas are used for hay or pasture or as woodland. This soil has good potential for agricultural crops and most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Erosion and runoff are the major hazards in the use of this soil for cultivated crops. Minimum tillage, crop rotation, contour farming, crop residue management, terraces, diversions, and grassed waterways can be used to control erosion, improve organic matter content, and maintain good soil tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is a moderate limitation to the use of this soil for woodland. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap root systems.

This soil is moderately limited for building sites because of moderate shrink-swell potential. Back filling foundations with sand or gravel and properly designing foundations help overcome these limitations. This soil has slight limitations for septic tank absorption fields. It has severe limitations for local roads and streets because of frost action and low strength. Strengthening the base material with more suitable fill of higher strength and installing subsurface drains or open ditches along roadways to remove excess water helps overcome these problems.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

AfC2—Alford silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and well drained. The soil is on loess-covered uplands. It is on side slopes and around the heads of drainageways. Individual areas are irregularly shaped and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. It contains yellowish brown material from the subsoil. The subsoil is about 36 inches thick. It is yellowish brown and strong brown, firm silty clay loam. The underlying material, to a depth of 60 inches, is brown silt loam. There are a few small areas of a similar soil that has slopes of 2 to 6 percent. In many areas the surface layer is yellowish brown silty clay loam, because the original surface layer has eroded away.

Included with this soil in mapping are a few small areas of Princeton soils on side slopes that finger into areas of the Alford soils. There are small areas of soils that have lost most or all of the surface layer through erosion. These soils are mainly on sharp breaks around drainageways. Also included are areas of alluvial deposits in the bottom of drainageways. These inclusions make up about 5 to 15 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface water is medium. The surface layer has moderate organic matter content and is friable and easy to till.

Most areas of this soil are used for growing corn, soybeans, and small grain. Some areas are used for hay and pasture and some are woodland. This soil has fair potential for agricultural crops and most engineering uses.

This soil is suited to corn, soybeans, and small grain. Erosion and runoff are the major hazards in the use of this soil for cultivated crops. Minimum tillage, crop rotation, contour farming, crop residue management, terraces, diversions, and grassed waterways can be used to control erosion and runoff, improve organic matter content, and maintain good soil tilth.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees, and a few small areas have existing stands of native hardwoods. Plant competition is a moderate limitation in the use of this soil for woodland. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap root systems.

This soil is moderately limited for building sites because of slope and moderate shrink-swell potential. Designing the buildings to complement the slope, backfilling foundations with sand or gravel, and properly designing foundations to compensate for shrink-swell potential overcome these limitations. This soil has moderate limitations for septic tank absorption fields because of slope. Installing the absorption field on the contour, modifying the slope, or, if available, connecting into a central sewer system are ways of overcoming the problem. This soil has severe limitations for local roads and streets because of frost action and low strength. Strengthening base material with a more suitable fill and installing subsurface drains or open ditches along roadways to remove excess water from the freezing zone help in overcoming the problem.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

AfE2—Alford silt loam, 15 to 25 percent slopes, eroded. This moderately steep, well drained soil is on loess-covered uplands. It is on side slopes adjacent to major drainageways. Individual areas are irregularly shaped and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is brown silt loam that has a few pockets of yellowish brown silt loam. It is about 6 inches thick. The subsoil is about 34 inches thick. It is yellowish brown and strong brown, friable and firm silt loam and silty clay loam. The underlying material, to a depth of 60 inches, is brown silt loam. There are a few small areas of a similar soil where slopes are 12 to 15 percent or more than 25 percent. In many areas the surface layer is yellowish brown silt loam and silty clay loam, because the original surface layer has been eroded away.

Included with this soil in mapping are a few small areas of Wellston soils on the lower slopes adjacent to bottom lands. There are also small areas of Princeton soils fingering into areas of the Alford soils. Also included are small areas of alluvial soils in the bottom of drainageways. These inclusions make up about 5 to 15 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is rapid. The surface layer has moderate organic matter content and is friable and easy to till.

Most areas of this soil are used for pasture or are woodland. A few small areas are cropped to corn, soybeans, or small grain. This soil has poor potential for agricultural crops and most engineering uses.

This soil is generally not suited to corn and soybeans. Runoff and erosion are the major hazards in the use of this soil for cultivated crops.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing should be avoided because of the hazards of excessive runoff and erosion. Grazing when the soil is too wet causes surface compaction and poor tilth and reduces the density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees, and some areas have existing stands of native hardwoods. This soil has moderate limitations for woodland because of slope and rapid runoff. The hazards are erosion, use of equipment, and plant competition. Placing haul roads on the contour, selective rather than clear cutting as a harvesting method, and leaving as much vegetation as possible are all means of controlling erosion. Proper timing of planting and harvesting also helps to minimize erosion. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is suited to trees that have tap root systems.

This soil is severely limited for building sites and septic tank absorption fields because of slope. Designing structures to fit the slope or grading the soil to modify the slope are ways of overcoming the problem. Some better sites for buildings and septic tank absorption fields are on the less sloping inclusions within this unit. This soil has severe limitations for local roads and streets because of frost action, low strength, and slope. Cutting and filling, locating on less sloping inclusions, strengthening base material with a more suitable fill, and placing subsurface drains or open ditches along roadways to remove excess water from the freezing zone help in overcoming these problems.

This soil is in capability subclass VIe and woodland suitability subclass 1r.

Ba—Bartle silt loam. This nearly level soil is deep and somewhat poorly drained. It is on low, alluvial terraces adjacent to bottom lands. Individual areas are irregular in shape and are dominantly 15 to 20 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 10 inches thick. The subsurface layer is pale brown silt loam about 7 inches thick. The subsoil is about 33 inches thick. The upper part is light brownish

gray, mottled, firm silt loam and silty clay loam, and the lower part is a very firm and brittle fragipan of light brownish gray, mottled, silty clay loam and silt loam. The underlying material, to a depth of 60 inches, is light brownish gray, light gray, and yellowish brown stratified silt loam, silty clay loam, and fine sand. In some places, the slope is more than 2 percent.

Included with this soil in mapping are small areas of poorly drained Peoga soils and moderately well drained Pekin soils. The Peoga soils are in slightly depressional areas of the landscape. The Pekin soils are in areas near the terrace breaks. These inclusions make up 5 to 15 percent of the unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easily tilled. A seasonal high water table is at a depth of 1 to 2 feet during the months of January through April. A very firm and brittle fragipan, at a depth of 24 to 36 inches, restricts the downward movement of roots.

Most of this soil is used for growing corn, soybeans, or small grain. A few areas are used for hay or pasture or are in woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain when adequately drained. Wetness is the major limitation in use and management. Excessive water can be removed by open ditches, surface drains, subsurface drains, or a combination of these. Since the very slowly permeable fragipan restricts water movement, this soil is often saturated in winter and spring months. This causes a delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help to improve and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. Alfalfa and other deep rooted legumes are not suited, because this soil is wet and root growth is restricted by the fragipan. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness hinders harvesting and logging and also the planting of seedlings.

This soil is severely limited for building sites. The seasonal high water table is the main limitation. An adequate drainage system helps correct this limitation. Limitations for septic tank absorption fields are severe because of very slow permeability and a seasonal high water table. Increasing the size of the absorption field and installing adequate drainage to lower the seasonal high water table helps overcome the limitation. Central sewer systems are usually needed because these limitations in soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of frost action, a seasonal high water table, and low strength. Strengthening the base materials with a more suitable fill and installing drainage to lower the water table helps in overcoming the limitations.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

Bo—Bonnie silt loam. This nearly level soil is deep and poorly drained. It is on broad and level or slightly concave flood plains. It is subject to frequent flooding. Individual areas of this unit are irregular in shape and are dominantly 60 to 90 acres in size.

In a typical profile, the surface layer is grayish brown, mottled silt loam about 12 inches thick. To a depth of about 60 inches, the underlying material is light gray, mottled silt loam. In some places, the surface layer is darker. In a few areas, the surface layer and underlying material have a higher content of sand.

Included with this soil in mapping are small areas of somewhat poorly drained Stendal and moderately well drained Steff soils. They are nearly level, and on meandering, convex slopes. There are also a few small areas of wet, marshy soils that have no drainage outlet in this unit. Also included are small areas of mucky soils. These inclusions make up about 3 to 10 percent of the unit.

This soil has high available water capacity and is slowly permeable. Surface runoff is very slow or slow. The surface layer has low organic matter content and is friable and easily tilled. A seasonal high water table is within 1 foot of the surface during the months of December through June.

Most of this soil is used for growing corn, soybeans, or small grain. Some areas are used for hay or pasture and some are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to corn, soybeans, and some small grain, if adequately drained. The seasonal high water table is a limitation and frequent flooding is a hazard in the use and management of this soil. Flooding normally occurs before the major crops in the area are planted. Adequate drainage is sometimes difficult to establish because suitable outlets are not always available. Subsurface drains and open ditches are used to lower the water table. Flooding can be controlled in some areas by levees and properly placed diversions to intercept runoff from higher ground. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help to improve and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and legumes for hay and pasture. Alfalfa and other deep rooted legumes are not suited to this soil because of the seasonal high water table and the potential damage from flooding. Drainage

is necessary to attain high yields of grasses and legumes. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and reduces density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to reduce surface compaction and maintain good tilth and density of plant growth.

This soil is suited to trees. Equipment limitation, seedling mortality, and windthrow hazard are severe in the use of this soil for woodland. Prolonged wetness usually delays harvesting or planting until seasons when the soil is extremely dry or is frozen. Water-tolerant species should be favored in timber stands. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for building sites and septic tank absorption fields because of a seasonal high water table. It is generally not suited for these purposes because it is susceptible to flooding. Areas used for these purposes must be drained and protected from flooding. Installing levees and filling to elevate the construction above the highest known flood level are ways of overcoming the flood hazard. The soil has severe limitations for local roads and streets because of frost action, a seasonal high water table, and flooding. Drainage is needed to lower the water table and fill is often needed to elevate the roadbed above the highest flood level or to provide sufficient drainage.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

Bu—Burnside silt loam. This nearly level soil is deep and well drained. This soil is on flood plains. It is subject to occasional flooding. Individual areas are on flats in narrow bottoms or major drainageways and their tributaries. They are long and irregular in shape and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is dark grayish brown and brown silt loam about 12 inches thick. The underlying material, to a depth of about 46 inches, is brown, friable channery loam and very channery loam. Below this is soft shale and sandstone bedrock. There are a few small areas of similar soil that have slopes of about 3 percent. Some areas have a channery or gravelly surface. In some areas, the underlying material is medium acid or slightly acid.

Incuded with this soil in mapping are a few areas of well drained Cuba soils in broader areas of the flood plains. Also included are small areas of the Burnside soil that is less than 40 inches deep to bedrock. These inclusions make up about 10 to 15 percent of the unit.

This soil has low available water capacity and is moderately permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easily tilled, except in those areas where rock fragments are present on the surface. Depth to a seasonal high water table ranges from 3 to 5 feet during the months of January through June.

Most areas of this soil are used for hay and pasture or are woodland. A few areas are used for corn, soybeans, and small grain. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to corn, soybeans, and small grain. Low or moderate available water capacity and stoniness are limitations and occasional overflow is a hazard in the use of this soil for cropland. Flooding normally occurs before the major crops in the area are planted. Planting early maturing varieties helps overcome the problem of droughtiness. Flooding can be controlled in some areas by levees and by diversions around the higher ground to intercept runoff that would cause head-water flooding. Minimum tillage, returning crop residue to the soil, and using cover crops help maintain tilth and organic matter content.

This soil is suited to grasses and legumes for hay and pasture. Hay and pasture fields may be subject to severe damage during periods of flooding. Overgrazing or grazing when the soil is too wet causes surface compaction, reduces density of plant growth, and causes poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is a moderate limitation. Occasional flooding in the winter is a hazard to logging. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling of unwanted trees and shrubs. Species tolerant to occasional periods of flooding should be favored in timber stands.

This soil is severely limited for building sites and septic tank absorption fields and generally is not suited for these uses because of flooding. Installing levees and filling to elevate the construction above the highest known flood level are ways of overcoming the flood hazard. Building on fill material also helps eliminate the problem of depth to bedrock. This soil has severe limitations for local roads and streets because of flooding. Fill is often needed to elevate the roadway to provide sufficient protection from flooding.

This soil is in capability subclass IIs and woodland suitability subclass 1o.

Ch—Chagrin silt loam. This nearly level soil is deep and well drained. It is on flood plains that are subject to frequent flooding. Individual areas of this map are irregular in shape and are dominantly 80 to 100 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is yellowish brown, friable silt loam, about 22 inches thick. The underlying material, to a depth of 60 inches, is yellowish brown loam and fine sandy loam. In a few areas the surface layer is loam.

Included with this soil in mapping are areas of a soil that has a higher content of sand throughout the profile. This soil is near the riverbanks. A few areas of somewhat poorly drained and moderately well drained soils, mainly in depressions and drainageways, are also included. There are some areas of Chagrin soils near drainageways where slopes are over 2 percent. These inclusions make up 10 to 15 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easily tilled. Reaction of the surface layer is usually slightly acid or neutral.

Most of this soil is used for growing corn, soybeans, or small grain. A few areas are used for hay and pasture or are woodland. The soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Flooding is a hazard in the use and management of this soil, but normally occurs before the major crops in the area are planted. Flooding can be controlled in some areas by levees and properly placed diversions to intercept runoff from higher ground. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help to improve and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and legumes for hay and pasture. Flood protection is needed for high yields. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and reduces density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil has severe limitations for building sites and septic tank absorption fields and generally is not suited for these uses, because it is subject to flooding. Areas used for this purpose must be protected from flooding. In some areas, flooding can be controlled by levees and properly placed diversions to intercept surface runoff from higher ground. Installing levees and filling to elevate construction above the highest known flood level are ways of overcoming the flood problem. This soil has severe limitations for local roads and streets because of flooding. Fill is often needed to elevate the roadbed to provide sufficient protection from flooding.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

Cu—Cuba silt loam. This nearly level soil is deep and well drained. It is on the flood plains that are subject to occasional flooding. Individual areas of this unit are irregular in shape and are dominantly 20 to 60 acres in size.

In a typical profile, the surface layer is brown silt loam about 10 inches thick. The subsoil is about 37 inches thick. It is friable silt loam. It is a dark yellowish brown in the upper part, and yellowish brown in the lower part. The underlying material, to a depth of 60 inches, is brown, mottled silt loam. In some areas near the streams, the soil has a higher content of sand in the surface layer and subsoil. In a few areas this soil is medium acid throughout.

Included with this soil in mapping are small areas of somewhat poorly drained Stendal, moderately well drained Steff, and well drained Burnside soils. Stendal and Steff soils are more nearly level and are usually near the base of the uplands and in drainageways. Burnside soils are in areas that finger into areas of the Cuba soil and are along the larger streams. Also included are small areas of gently sloping Cuba soils along drainageways. These inclusions make up about 5 to 15 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easily tilled.

Most of this soil is used for growing corn, soybeans, or small grain (fig. 3). A few areas are used for hay and pasture or are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

Figure 3.—Crops on Cuba silt loam and woodland on Gilpin silt loam, 18 to 25 percent slopes, eroded, is good land use.

This soil is well suited to corn, soybeans, and small grain. Flooding is a hazard in the use and management of this soil but normally occurs before the major crops in the area are planted. Flooding can be controlled in some areas by installing levees and properly placing diversions to intercept runoff from higher ground. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help to improve and to maintain tilth and organic matter content of this soil.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth and reduces the density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for building sites and septic tank absorption fields and generally is not suited for these uses because it is subject to flooding. Areas used for these purposes must be protected from flooding. In some areas, flooding can be controlled by installing levees and by properly placing diversions to intercept surface runoff from higher ground. Installing levees and filling to elevate construction above the highest known flood level are ways of overcoming the flood problem. This soil has severe limitations for local roads and streets because of frost action and flooding. Fill is often needed to elevate the roadbed to provide sufficient drainage and protection from flooding.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

DuA—Dubois silt loam, 0 to 2 percent slopes. This nearly level soil is deep and somewhat poorly drained. This soil is on loess-capped lake plains. It is on broad flats between drainageways. Individual areas are irregularly shaped and are dominantly 60 to 80 acres in size.

In a typical profile, the surface layer is brown silt loam about 10 inches thick. The subsurface layer is light yellowish brown silt loam about 6 inches thick. The subsoil, to a depth of 80 inches, has this sequence. The upper part is light brownish gray, mottled, firm silty clay loam; the next part is a very firm and brittle fragipan of light brownish gray and dark yellowish brown, mottled silty clay loam and loam; the next part is dark yellowish brown, friable sandy loam; and the lower part is strong brown, stratified sandy clay loam, sandy loam, and loamy sand. There are a few areas of similar soil that has slopes of 2 to 6 percent.

Included with this soil in mapping are a few small areas of well drained Otwell and poorly drained Peoga soils. The Otwell soils are on higher positions of the flats and along breaks near drainageways. The Peoga soils are in depressions and in the bottoms of flat drainageways. These inclusions make up about 5 to 10 percent of the unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easy to till. A seasonal high water table is at a depth of 1 to 3 feet between the months of January and April. A very firm and brittle fragipan, at a depth of 20 to 36 inches, restricts the downward movement of roots.

Most of this soil is used for growing corn, soybeans, and small grain. A few areas are used for hay and pasture or are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, or small grain when adequately drained. Wetness is the major limitation in the use and management of this soil for cropland. Excess water can be removed by open ditches, surface drains, subsurface drains or a combination of these practices. Since the very slowly permeable fragipan restricts water movement, this soil is often saturated in winter and spring months, which causes delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help improve and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. Alfalfa and other deep rooted legumes are not suited to this soil because they are wet and root growth is restricted by the frapipan. Overgrazing should be avoided. Grazing when the soil is too wet causes surface compaction and poor tilth and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Seedling mortality and windthrow hazard are moderate in the use of this soil for woodland. Water-tolerant trees should be favored in selecting species to plant. Prolonged seasonal wetness hinders logging and the planting of seedlings.

This soil is severely limited for building sites because of wetness. Areas are sometimes difficult to drain because they lack adequate outlets for drainage. Grading of the soil and surface drainage leading to subsurface or storm drains help remove excess surface water. Peripheral subsurface drains around lots help in removing subsurface water. The soil has severe limitations for septic tank absorption fields because of wetness and very slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the seasonal high water table help overcome the limitations. Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of frost action and low strength.

Strengthening the base material with more suitable fill and installing subsurface drains or open ditches along roadways to remove excess water from the freezing zone help in overcoming the limitations.

This soil is in capability subclass IIw and woodland suitability subclass 3d.

DuB—Dubois silt loam, 2 to 6 percent slopes. This gently sloping soil is deep and somewhat poorly drained. This soil is on loess-capped lake plains. It is on low convex ridges of flats and around shallow, flat drainageways. Individual areas are irregularly shaped and are dominantly 10 to 20 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is pale brown silt loam about 6 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is light brownish gray and grayish brown, mottled, firm silty clay loam; the next part is a very firm and brittle fragipan of dark yellowish brown and strong brown, mottled silty clay loam and loam, and the lower part is brown, mottled, stratified sandy loam and sandy clay loam. There are a few areas of similar soils that have slopes of 0 to 2 percent.

Included with this soil in mapping are a few small areas of well drained Otwell soils. The Otwell soils are more strongly sloping and are around drainageways. Inclusions make up about 10 to 15 percent of this unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easy to till. Reaction of the surface layer varies widely as a result of local liming practices. A seasonal high water table is at a depth of 1 to 3 feet between the months of January and April. A very firm and brittle fragipan, at a depth of 20 to 36 inches, restricts the downward movement of roots.

Most of this soil is used for growing corn, soybeans, and small grain. A few areas are used for hay and pasture, and some are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, or small grain when adequately drained. Wetness is the major limitation in the use and management of this soil for crops. Excess water can be removed by open ditches, subsurface drains, surface drains, or a combination of these. Since the very slowly permeable fragipan restricts water movement, this soil is often saturated in winter and spring months, which causes delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. Minimum tillage, crop residue management, terraces, diversions, grassed waterways, and using cover crops and green manure crops help control erosion and improve and maintain tilth and organic content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. Alfalfa and other deep rooted legumes are not suited to this soil because they are wet and root growth is restricted by the fragipan. Overgrazing should be avoided. Grazing when the soil is too wet causes surface compaction, poor tilth, excessive runoff and erosion, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Seedling mortality and windthrow hazard are moderate in the use of this soil for woods. Water-tolerant trees should be favored in selecting species to plant. Prolonged seasonal wetness hinders logging and planting seedlings.

This soil is severely limited for building sites because of wetness. Grading of soil and installing surface drains leading to subsurface or storm drains help remove excess surface water. Peripheral subsurface drains around lots help in removing subsurface water. The soil has severe limitations for septic tank absorption fields because of wetness and very slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the seasonal high water table help overcome the limitations. Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of frost action and low strength. Strengthening the base material with more suitable fill and installing subsurface drains or open ditches along roadways to remove excess water from the freezing zone help overcome the limitations.

This soil is in capability subclass IIe and woodland suitability subclass 3d.

GlD2—Gilpin silt loam, 12 to 18 percent slopes, eroded. This strongly sloping soil is moderately deep and well drained. This soil is on uplands. It is on side slopes along drainageways and hillsides. Individual areas are irregularly shaped. They are dominantly 10 to 25 acres in size.

In a typical profile, the surface layer is brown silt loam and pockets of strong brown silt loam. It is about 6 inches thick. The subsoil is about 22 inches thick. The upper part is yellowish brown, friable channery silt loam; the middle part is strong brown, firm channery clay loam, and the lower part is strong brown, friable channery loam. Rippable sandstone and shale are at a depth of about 28 inches. Some areas of a similar soil have a thicker surface layer and subsoil and contain fewer coarse fragments. In areas where the surface layer has been eroded away, the upper part of the subsoil has been mixed with the original surface layer by plowing and the present surface layer is yellowish brown silt loam. In places some moderately sloping soils have fewer coarse fragments.

Included with this soil in mapping are small areas of well drained Zanesville soils and Gilpin soils that have had the surface layer removed by erosion. Zanesville soils are less sloping and are on and near the ridgetops. Also included are areas of colluvial soils, mainly at the foot of slopes, which are over 40 inches deep to bedrock. There are also small areas of alluvial soils along the drainageways, and some areas where rock crops out. These inclusions make up 10 to 15 percent of this unit.

This soil has low available water capacity and is moderately permeable. Surface runoff is rapid. The surface layer has moderate organic matter content and is friable.

Most areas of this soil are used for pasture or hay (fig. 4). Some areas are cropped to corn, soybeans, or small grain, and some are woodland. This soil has fair potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to small grain. Row crops can be grown occasionally. Erosion and runoff are the major hazards in the use of this soil for cultivated crops. Minimum tillage, crop rotations, crop residue management, diversions, and grassed waterways can be used to help control erosion and runoff, improve organic matter content, and maintain good soil tilth.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff and erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees and some areas have existing stands of native hardwoods. Erosion hazard and equipment limitations are moderate in the use of this soil for woods. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory as possible help control erosion. Some equipment for logging and planting is difficult to use because of the slope of the soil. Using specialized equipment and carefully planning logging and planting may help overcome this problem.

This soil is severely limited for building sites, septic tank absorption fields, and local roads and streets because of slope. Depth to rock is also a limitation for some uses. Grading the soil to modify the slope and to increase depth over bedrock or designing structures to complement the slope helps overcome the limitations. Selecting an alternate site on a more suitable soil should be considered.

This soil is in capability subclass IVe and woodland suitability subclass 2r.

GlD3—Gilpin silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping soil is moderately deep and well drained. The soil is on uplands. It is on side slopes along drainageways. Individual areas are ir-

Figure 4.—Area of Gilpin silt loam, 12 to 18 percent slopes, eroded, in permanent pasture. This soil is also suited to growing small grain and to woodland.

regularly shaped. They are dominantly 15 to 40 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil is about 20 inches thick. The upper part is strong brown, friable clay loam, and the lower part is strong brown, friable channery loam. Rippable sandstone is at a depth of about 26 inches. In many areas the present surface layer is strong brown, channery clay loam because the original surface layer has been eroded away.

Included with this soil in mapping are small areas of well drained Wellston and Zanesville soils and Gilpin soils that have a less eroded surface layer. Wellston soils are less sloping and are mainly on the lower side slopes. Zanesville soils are also less sloping but are on and near the ridgetops. The less eroded Gilpin soil that has a thicker surface layer is mainly on the lower part of the side slopes. Also included are small areas of alluvial soils along drainageways; small areas of gullies, mainly on the parts of upper slopes; and colluvial soils, mainly at the base of the slopes, which are over 40 inches deep to bedrock. Rock outcrops are in some areas (fig. 5). These inclusions make up about 15 to 20 percent of this unit.

This soil has low available water capacity and is moderately permeable. Surface water runoff is very rapid. The surface layer has low organic matter content and is friable.

Most areas of this soil are used for pasture or hay. A few areas are cropped to corn, soybeans, or small grain and some are woodland. This soil has poor potential for agricultural crops and most engineering uses.

This soil is generally not suited to corn and soybeans. Runoff and further erosion are major hazards in the use of this soil for cultivated crops. Small grain can be grown occasionally.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth, excessive runoff and erosion, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Erosion hazard and equipment limitations are moderate in the use of this soil for woods. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. Use of some equipment in logging and planting is difficult because of slope. Using specialized equipment and carefully planning logging and planting may help overcome this problem.

This soil has severe limitations for building sites, septic tank absorption fields, and local roads and streets. Grading the soil to modify the slope and to increase depth over bedrock or designing structures to complement the slope helps in overcoming the limitations. Selecting an

Figure 5.—In some areas of Gilpin silt loam, 12 to 18 percent slopes, severely eroded, there are sandstone outcrops.

alternative site on more suitable soil should be considered.

This soil is in capability subclass VIe and woodland suitability subclass 2r.

GIE—Gilpin silt loam, 18 to 25 percent slopes. This moderately steep soil is moderately deep and well drained. This soil is on uplands. It is on hillsides and sharp breaks along drainageways. Industrial areas are irregularly shaped. They are dominantly 20 to 80 acres in size.

In a typical profile, the surface layer is brown silt loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is yellowish brown, friable channery silt loam; the middle part is strong brown, firm channery clay loam; and the lower part is yellowish brown, friable channery loam. Rippable sandstone and shale bedrock is at a depth of about 28 inches. In a few small areas, a similar soil has a thicker surface layer and fewer coarse fragments in the subsoil. There are small areas of this soil that has 12 to 18 percent slopes or small areas where the surface layer has been removed by erosion.

Included with this soil in mapping are a few small areas of well drained Wellston and well drained Berks soils. The Wellston soils are mainly on bench areas on the side slopes. The Berks soils are mainly on the breaks along drainageways. Rock outcrops are in some areas. Also included are colluvial soils, mainly at the base of the slopes, which are over 40 inches deep to bedrock and small areas of alluvial soils along drainageways. These inclusions make up about 10 to 12 percent of this unit.

This soil has low available water capacity and is moderately permeable. Surface runoff is rapid. The surface layer has moderate organic matter content and is friable.

Most areas of this soil are used for pasture or are woodland. A few areas are cropped to corn, soybeans, and small grain or are used for hay. This soil has poor potential for agricultural crops and most engineering uses.

This soil is generally not suited to corn and soybeans. Runoff and erosion are major hazards in the use of this soil for cultivated crops. The steepness of the slope makes it difficult to use most pieces of standard farm machinery.

This soil is suited to grasses and legumes for hay and pasture. Droughtiness is a hazard during long periods of little or no rainfall. Drought-tolerant species should be considered for pastures and hay fields. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff and erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees and many areas have existing stands of native hardwoods. Slope is a limitation and erosion a hazard in the use of this soil for woods. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. Use of some equipment in logging and planting is difficult because of the steepness of the slopes. Using specialized equipment and carefully planning logging and planting may help overcome this problem.

This soil is severely limited for building sites, septic tank absorption fields, and local roads and streets because of slope. Depth to rock is also a limitation for some uses. Grading to modify the slope or designing structures to complement the slope may help in overcoming the limitations. Selecting an alternate site on more suitable soils should be considered.

This soil is in capability subclass VIe and woodland suitability subclass 2r.

GIE3—Gilpin silt loam, 18 to 25 percent slopes, severely eroded. This moderately steep soil is moderately deep and well drained. The soil is on uplands. It is on hillsides and on sharp breaks along drainageways. Individual areas are irregularly shaped. They are dominantly 10 to 35 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 4 inches thick. The subsoil is about 21 inches thick. The upper part is strong brown, firm channery silty clay loam; the middle part is brown, friable channery loam; and the lower part is brownish yellow, friable very channery loam. Rippable sandstone and shale bedrock is at a depth of 25 inches. In many areas the present surface layer is strong brown channery silty clay loam, because the original surface layer has been eroded away.

Included with this soil in mapping are a few small areas of well drained Berks soils and Gilpin soils that have 12 to 18 percent slopes or that have a thicker, less eroded surface layer. Berks soils are mainly on the steeper side slopes along drainageways. The less eroded Gilpin soils are on the lower part of slopes or on benches. Bedrock crops out in some areas. Also included are small areas of gullies, mainly on the upper parts of slopes, and small areas of alluvial soils along drainageways. Where the soil is over clay shale, the lower part of the subsoil and underlying material is silty clay or clay. These inclusions make up about 10 to 20 percent of this unit.

This soil has low available water capacity and is moderately permeable. Surface water runoff is very rapid. The surface layer has low organic matter content and is friable and highly erosive.

Most areas of this soil are used for pasture or are woodland. A few small areas are cropped to corn, soybeans, and small grain or are used for hay. This soil has poor potential for agricultural crops and most engineering uses.

This soil is generally not suited to corn, soybeans, and small grain. Runoff and further erosion are the major

hazards in the use of this soil for cultivated crops. The steepness of the slope makes it difficult to use most pieces of standard farm machinery.

This soil is suited to grasses and legumes for hay and pasture. Droughtiness is a hazard during long periods of little or no rainfall. Drought-tolerant species should be considered for pastures and hay fields. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff and erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Slope is a limitation and erosion a hazard in the use of this soil for woods. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. Use of some equipment in logging and planting is difficult because of the steepness of the slopes. Using some specialized equipment and carefully planning logging and planting may help overcome this problem.

This soil is severely limited for building sites, septic tank absorption fields, and local roads and streets because of slope. Depth to rock is also a limitation for some uses. Grading the soil to modify the slope or designing structures to complement the slope help in overcoming the limitations. Selecting an alternate site on more suitable soils should be considered.

This soil is in capability subclass VIe and woodland suitability subclass 2r.

GoF—Gilpin-Berks complex, 20 to 50 percent slopes. This map unit consists of moderately steep to very steep Gilpin and Berks soils that are moderately deep and well drained. These soils are on hillsides and are in the uplands. Individual areas of this unit are about 50 percent Gilpin soils and about 35 percent Berks soils. They are dominantly 40 to 200 acres in size. Areas of the Gilpin and Berks soils are so intricately mixed that it is not practical to separate them in mapping.

In a typical profile of the Gilpin soil, the surface layer is brown silt loam about 6 inches thick. The subsoil is about 22 inches thick. It is yellowish brown, friable silt loam in the upper part; strong brown, friable channery clay loam in the middle part; and brownish yellow channery loam in the lower part. Rippable sandstone and shale bedrock is at a depth of 28 inches.

In a typical profile of the Berks soil, the surface layer is dark grayish brown channery silt loam about 3 inches thick. The subsurface layer is yellowish brown channery silt loam about 5 inches thick. The subsoil is yellowish brown, friable channery silt loam about 21 inches thick. Below this is rippable sandstone bedrock.

Included in mapping of this unit are a few areas of shallow soils, soils where bedrock is exposed, and Wellston soils. The shallow soils generally are immediately above the rock outcrops and are well drained. Wellston soils are deep and well drained and are on less sloping benches, toe slopes, and narrow ridgetops. Also included are cleared areas of Gilpin and Berks soils that have lost most or all of the surface layer by erosion and areas of alluvial soils along the drainageways. These inclusions make up from 10 to 15 percent of this unit.

The soils in this unit have low available water capacity and are moderately permeable. Surface runoff is very rapid. The surface layer has moderate organic matter content and is friable; however, tillage is difficult or impossible because of the steepness of the slope and presence of stones on the surface.

Most ares of these soils are woodland (fig. 6). A few small areas are used for pasture. The pasture is primarily on the less sloping included soils. These soils have poor potential for agricultural crops and most engineering uses.

These soils are generally not suited to cropland. The steepness of the soils makes it difficult to use most standard pieces of farm equipment. Stones on the surface and rock outcrops in the unit are also limitations to tillage.

These soils are not suited to grasses and legumes for hay and pasture because of slope and stoniness. Some pastures can be established on the less sloping included soils, but access to them may be difficult.

These soils have fair potential for woodland. Slope and erosion are the main limitations in the use of these soils for woods. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. The limitation on equipment is severe because of the steep slopes. Using very specialized equipment and carefully planning logging may help overcome this problem.

These soils have severe limitations for building sites, septic tank absorption fields, and local roads and streets. They are generally not suited to these uses because of slope. Depth to rock is also a limitation for some uses. Grading the soil to modify the slope, designing structures to complement the slope, or constructing on less sloping soils may help in overcoming some of the limitations. Selecting an alternative site on more suitable soils should be considered.

This complex is in capability subclass VIIe; the Gilpin part is in woodland suitability subclass 2r and the Berks part is in woodland suitability subclass 3f.

GuD—Gilpin-Orthents complex, 12 to 25 percent slopes. This complex consists of strongly sloping and moderately steep soils that have been severely gullied. Gilpin soils are on narrow ridges between gullies. Individual areas are about 50 percent Gilpin soils and about 40 percent Orthents. They are irregular in shape and are dominantly 7 to 20 acres in size.

In a typical profile the Gilpin soil has a surface layer of dark yellowish brown silt loam about 4 inches thick. The

Figure 6.—Most areas of Gilpin-Berks complex, 20 to 50 percent slopes, are used for woodland.

subsoil is about 23 inches thick. The upper part is strong brown, friable silty clay loam; the middle part is strong brown, friable channery silt loam; and the lower part is strong brown, friable channery loam. Sandstone bedrock is below a depth of 27 inches.

The Orthents part of the unit consists of gullied soils. These soils have been radically altered by erosion. The soil material is mainly channery silt loam and channery loam that is 10 to 20 inches deep to sandstone, siltstone, or shale bedrock. In places where gullies converge, there is deposition or a buildup of soil material that washed from the slopes above.

Included with this unit in mapping are small areas of moderately sloping Zanesville soils, mainly on the upper parts of the slopes near the ridgetop. Also included are areas of gullied land on very steep or nearly vertical side slopes. Many of the gullies have been cut into the soft bedrock as deep as 6 feet below the surface. These inclusions make up about 10 percent of the unit.

These soils have low available water capacity and are moderately permeable. Surface runoff is very rapid. The surface layer has low or moderate organic matter content. The surface layer and subsoil are strongly acid or very strongly acid.

Most areas of these soils are presently unused. Shrubs, weeds, and wild grasses grow on soils between gullies and, in some places, in the bottoms of gullies. In some areas, soils have been planted to trees. These soils have poor potential for agricultural crops and most engineering uses.

These soils are not suited to corn, soybeans, or small grain because of the large number of gullies and the steep sides of the gullies.

These soils are poorly suited to grasses and legumes for hay and pasture because of the size and number of gullies. In some areas, cutting and filling can reshape the land surface so that farm machinery can be used to establish grasses and legumes.

This unit is suited to selected species of trees. Planting pine trees stabilizes the soil material and controls erosion.

These soils have severe limitations for building sites. The steep side slopes of the gullies and the depth to bedrock are the main limitations. Cuts and fills are needed. In some areas, bedrock needs to be cut out for basements. Diversions help control runoff and erosion. These soils have severe limitations for septic tank absorption fields because of slope and depth to rock. Grading the soil to modify the slope, increasing the size of the absorption field, and installing structures on the contour help to correct these limitations. The soils are severely limited for local roads and streets because of the slope. Cuts and fills are needed to modify the slope.

This complex is in capability subclass VIIe. The Gilpin part is in suitability subclass 2r, and Orthents are not assigned to a woodland suitability subclass.

JoA—Johnsburg silt loam, 0 to 2 percent slopes. This nearly level soil is deep and somewhat poorly drained. This soil is in broad or slightly depressional areas of ridgetops and is on the uplands. Individual areas of this unit are irregular in shape and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 54 inches thick. The upper part is light yellowish brown, friable silt loam; the next part is brownish yellow, firm silt loam; the next part is light brownish gray, mottled, firm silty clay loam; and the lower part is a very firm fragipan of light brownish gray and yellowish brown, mottled silty clay loam and silt loam. Below a depth of about 62 inches is fine grained sandstone. A few small areas of soils that are grayer in the upper part of the subsoil are in swales or on flats at the heads of drainageways. There are also small areas that have slopes of more than 2 percent.

Included with this soil in mapping are a few small areas of moderately well drained Tilsit soils in slightly convex areas. This inclusion makes up about 3 to 10 percent of the unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 1 foot to 3 feet during the months of January through April. A very firm and brittle fragipan, at a depth of 20 to 36 inches, restricts the downward movement of roots.

Most areas of this soil are used for growing corn, soybeans, and small grain. Many areas are used for hay and pasture and some are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain when adequately drained. Excess water can be removed by surface drains, subsurface drains, or a combination of these. Because the very slowly permeable fragipan restricts water movement, these soils are often saturated in winter and spring, which causes delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help to improve and to maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to deep rooted legumes, such as alfalfa, because roots are restricted by the fragipan and because it is excessively wet during spring and winter months. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled. This can be accomplished by site preparation, spraying, cutting, or girdling. The rooting zone is limited mainly to the area above the fragipan. Water-tolerant species are favored in timber stands. Prolonged seasonal wetness hinders harvesting and logging and also planting seedlings.

This soil is severely limited for building sites. The seasonal high water table is the main limitation. Buildings should be built without basements, and drains should be installed around foundations to help remove excess water. This soil has severe limitations for septic tank absorption fields because of the seasonal high water table and very slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the water table helps correct this limitation. Central sewer systems are usually needed in soils that have a fragipan because these limitations are difficult to overcome. This soil has severe limitations for local roads and streets because of the high potential for frost action. Adequate drainage systems should be installed to lower the water table and remove water from the freezing zone, so that frost action can be reduced.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

MgA—McGary silt loam, 0 to 2 percent slopes. This nearly level soil is deep and somewhat poorly drained. This soil is on lacustrine terraces adjacent to bottom

lands. Individual areas are irregular in shape and are dominantly 30 to 60 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is about 20 inches thick. It is light olive brown, mottled, firm silty clay. The underlying material, to a depth of 60 inches, is light brownish gray, mottled, stratified silty clay loam and silty clay and thin layers of silt loam.

Included with this soil in mapping are small areas of browner, better drained soils near drainageways and terrace breaks. McGary soils that have slopes of 2 to 12 percent, and are better drained are also included. Areas of these soils are mainly around the drainageways and on the steeper terrace breaks. Also included are small areas of very poorly drained Montgomery soils in slight depressions or concave areas. These areas make up 5 to 40 percent of the unit.

This soil has high available water capacity and is slowly or very slowly permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easy to work. Depth to a seasonal high water table ranges from 1 to 3 feet during the months of January through April.

Most areas of this soil are used for growing corn, soybeans, or small grain. A few areas are used for hay and pasture or woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to corn, soybeans, and small grain when adequately drained. Wetness is the major limitation for this soil. Excess water can be removed by open ditches or subsurface drains. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops improve and maintain organic matter content and good tilth.

This soil is suited to grasses and selected legumes for hay and pasture. Alfalfa is not well suited because of excessive wetness during winter and early spring. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Seedling mortality and windthrow hazard are severe. Some replanting of seedlings may be needed. The control and removal of unwanted trees and shrubs can be accomplished by proper site preparation or by spraying, cutting, or girdling. Water-tolerant species should be favored. Prolonged seasonal wetness hinders harvesting and logging and also the planting of seedlings.

This soil is severely limited for building sites. Seasonal high water table and a high shrink-swell potential are the main limitations. Houses should be built without basements and drains should be installed around foundations to help remove excess water. Foundations should be properly designed to prevent structural damage caused by shrinking and swelling of the soil. Backfilling with sand or gravel is usually needed. This soil has severe limitations for septic tank absorption fields because of a seasonal high water table and slow or very slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the water table help to correct these limitations. This soil has severe limitations for local roads and streets because of the high shrink-swell potential and low strength. This can be corrected by replacing or strengthening the base materials and installing adequate drainage to lower the water table.

This soil is in capability subclass IIIw and woodland suitability subclass 3c.

Mo—Montgomery silty clay loam. This nearly level soil is deep and very poorly drained. This soil is on lacustrine terraces adjacent to bottom lands. It is subject to ponding by surface runoff from adjoining, higher parts of the landscape. Individual areas are irregular in shape and are dominantly 40 to 60 acres in size.

In a typical profile, the surface layer is very dark grayish brown silty clay loam about 12 inches thick. The subsurface layer is very dark gray, mottled silty clay about 10 inches thick. The subsoil is dark gray and dark grayish brown, mottled, very firm silty clay about 24 inches thick. The underlying material, to a depth of 60 inches, is gray, mottled clay.

Included with this soil in mapping are small areas of somewhat poorly drained McGary soils on slightly higher positions of the landscape. These inclusions make up about 2 to 10 percent of the unit.

This soil has moderate available water capacity and is slowly or very slowly permeable. Surface runoff is very slow or the soil is ponded. The surface layer has high organic matter content. Reaction of the surface layer is usually slightly acid or neutral. The surface layer is difficult to work. If tilled when too wet or too dry, it becomes cloddy so that a seed bed is difficult to prepare. Depth to a seasonal high water table ranges from above the surface to 1 foot below the surface during the months of December through May.

Most areas of this soil are used for growing corn, soybeans, or small grain. A few areas are used for hay or pasture or are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to corn, soybeans, and small grain when adequately drained. Wetness is the major limitation for this soil. Excess water can be removed by open ditches or subsurface drains. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help maintain organic matter content and good tilth.

This soil is suited to grasses and selected legumes for hay and pasture. Alfalfa is not well suited because of excessive wetness during winter and early spring. Overgrazing or grazing when the soil is too wet causes sur-

face compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Equipment limitation, seedling mortality, and windthrow hazard are severe in the use of this soil for woods. Unwanted trees and shrubs can be controlled or removed by proper site preparation or by spraying, cutting, or girdling. Water-tolerant species should be favored. Prolonged seasonal wetness hinders harvesting and logging and also planting seedlings.

This soil is severely limited for building sites. A seasonal high water table, ponding, and a high shrink-swell potential are the main limitations. Houses should be built without basements, and drains should be installed around their foundations to help remove excess water. Foundations should be properly designed to prevent structural damage caused by shrinking and swelling and low strength of the soil. This soil has severe limitations for septic tank absorption fields because of a seasonal high water table, ponding, and slow or very slow permeability. Adequate drainage to lower the water table, installing diversions to intercept surface water from higher ground, and increasing the size of the absorption field help to correct these limitations. This soil has severe limitations for local roads and streets because of the seasonal high water table, high shrink-swell potential, ponding, and low strength. This can be corrected by strengthening the base materials and installing drainage to lower the water table. Fill is often needed to elevate the roadbed above the ponding level and to provide sufficient drainage.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

NeD3—Negley loam, 12 to 18 percent slopes, severely eroded. This strongly sloping soil is deep and well drained. This soil is on outwash terraces. It is on side slopes and sharp breaks around drainageways. Individual areas are long and irregularly shaped and are dominantly 5 to 15 acres in size.

In a typical profile, the surface layer is yellowish brown loam about 4 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is strong brown and yellowish red, firm sandy clay loam, and the lower part is yellowish red, friable, stratified sandy clay loam and sandy loam. In many areas the present surface layer is strong brown sandy clay loam, because erosion has washed away the former surface layer.

Included with this soil in mapping are a few small areas of well drained Parke soils, which are mainly less sloping and are between drainageways, and Negley soils that are not as severely eroded. There are also small areas of alluvial soils along the drainageways. These inclusions make up about 5 to 10 percent of this unit.

This soil has high available water capacity and is moderately or moderately rapidly permeable. Surface runoff is very rapid. The surface layer has low organic matter content and is friable, but easily eroded.

Most areas of this soil are used for growing corn, soybeans, and small grain. Some areas are used for hay and pasture, and a few areas are woodland. This soil has poor potential for agricultural crops and most engineering uses.

This soil is generally not suited to corn and soybeans. Runoff and the hazard of further erosion are the main limitations in the use of this soil for cultivated crops. Diversions and grassed waterways help control erosion and runoff.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing and grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff and erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Erosion hazard and equipment limitation are moderate in the use of this soil for woodland. Seedlings survive and grow well if competing vegetation is controlled by site preparation and spraying, cutting, or girdling. This soil is well suited to trees that have tap root systems. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory as possible help control erosion. Use of some equipment in logging and planting is difficult because of slope. Using specialized equipment and carefully planning logging and planting operations may help overcome this problem.

This soil is severely limited for building sites because of slope. Grading the soil to modify the slope or designing the building to complement the slope helps overcome this limitation. This soil has severe limitations for septic tank absorption fields because of slope. Grading the soil of the filter field to modify the slope or designing installations on the contour helps overcome the limitation. This soil has severe limitations for local roads and streets because of slope. Cuts and fills to modify the slope or designing roads and streets to fit the slope help overcome the limitation.

This soil is in capability subclass VIe and woodland suitability subclass 1r.

NeF—Negley loam, 18 to 50 percent slopes. This steep soil is deep and well drained. The soil is on outwash terraces. It is on steep hillsides and sharp breaks adjacent to major drainageways. Individual areas generally are long and irregularly shaped and dominantly are 5 to 15 acres in size.

In a typical profile, the surface layer is brown loam about 5 inches thick. The subsurface layer is yellowish brown, friable loam about 6 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The

upper part is strong brown, friable loam; the middle part is yellowish red, firm sandy clay loam; and the lower part is yellowish red, friable fine sandy loam.

Included with this soil in mapping are a few small areas of Parke soils and a few areas of Negley soils that have been cultivated and have lost their original surface layer by erosion. They are mainly less sloping and are between drainageways or on the crests of the steep slopes. Also included are small areas of alluvial soils along the drainageways. Soils that have loamy sand in the lower subsoil are also included. These inclusions make up about 5 to 15 percent of this unit.

This soil has high available water capacity and moderate permeability or moderately rapid permeability. Surface runoff is very rapid. The surface layer has moderate organic matter content and is friable and easily tilled.

Most areas of this soil are woodland, and a few small areas are used for pasture. The pasture is primarily on the less sloping, included soils. This soil has poor potential for agricultural crops and most engineering uses.

This soil is generally not suited for crops. The steepness of this soil makes it difficult to use most standard pieces of farm equipment. The hazard of erosion and excessive runoff are major limitations when this soil is cultivated.

This soil is poorly suited to grasses and legumes for hay and pasture because of slope. Some pastures can be established on the less sloping parts of the landscape. Because of the steepness of the soil, using most pieces of farm equipment is difficult.

This soil is suited to trees. Slope is the main limitation in the use of this soil for woods. The hazard of erosion and equipment limitations are moderate. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. Using very specialized equipment and carefully planning logging are necessary to overcome the hazard of steep slopes. Proper timing of planting and harvesting also helps to minimize erosion. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling of unwanted trees and shrubs.

This soil is severely limited for building sites, septic tank absorption fields, and local roads and streets and is generally not suited to these uses because of slope. Construction of buildings, roads, and septic tank absorption fields on the less sloping included soils may overcome some of the problems if special care is taken in designing and construction. An alternate site on more suitable soils should be considered.

This soil is in capability subclass VIIe and woodland suitability subclass 1r.

NgC2—Negley silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and well drained. This soil is on outwash terraces. Individual areas are irregularly shaped and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is brown silt loam that contains yellowish brown material from the subsoil. It is about 7 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is yellowish brown and strong brown, firm clay loam and sandy clay loam; and the lower part is brown and strong brown, friable, stratified loam, sandy loam, and sandy clay loam. In some areas the surface layer is loam. In areas where erosion has occurred, the upper part of the subsoil has been mixed with the original surface layer by plowing and the present surface layer is yellowish brown clay loam and silt loam.

Included with this soil in mapping are a few small areas of well drained Parke soils mainly on less sloping parts of the landscape. Inclusions make up about 6 to 10 percent of the unit.

This soil has high available water capacity and moderate permeability or moderately rapid permeability. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easy to work.

Most areas of this soil are used for growing corn, soybeans, and small grain. Some areas are used for hay and pasture, and some are woodland. This soil has fair potential for agricultural crops and most engineering uses.

This soil is suited to corn, soybeans, and small grain. Erosion and runoff are the major hazards in the use of this soil for cultivated crops. Minimum tillage, crop rotation, contour farming, crop residue management, terraces, diversions, and grassed waterways can be used to control erosion and runoff, improve organic matter content, and maintain good soil tilth.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. A few small areas have existing stands of native hardwoods. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap root systems.

This soil is moderately limited for building sites because of slope. Grading the soil to modify the slope or designing the building to complement the slope are ways to help overcome the limitation. The soil has moderate limitations for septic tank absorption fields because of slope. Installing absorption fields on the contour or modifying the slope help overcome the problem. The soil has moderate limitations for local roads and streets because of slope, frost action and low strength. Cuts and fills are often needed. Designing roads and streets to fit the

slope, installing adequate drainage along the road and strengthening the base materials help overcome these limitations.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

NgD2—Negley silt loam, 12 to 18 percent slopes, eroded. This strongly sloping soil is deep and well drained. This soil is on outwash terraces. It is on side slopes and sharp breaks along drainageways. Individual areas are long and irregularly shaped and are dominantly 5 to 20 acres in size.

In a typical profile, the surface layer is brown silt loam that contains strong brown material from the subsoil. It is about 7 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is strong brown, friable loam; the middle part is yellowish red, firm sandy clay loam; and the lower part is strong brown, and yellowish red, stratified, friable sandy clay loam and sandy loam. In areas where erosion has occurred the upper part of the subsoil has been mixed with the original surface layer by plowing and the present surface layer is strong brown loam and silt loam.

Included with this soil in mapping are a few small areas of well drained Parke soils that are less sloping and between drainageways. Also included are small areas of severely eroded Negley soils. Alluvial soils in the bottom of drainageways that have loamy sand in the lower part of the subsoil are also included. These inclusions make up 5 to 15 percent of this unit.

This soil has high available water capacity and has moderate permeability to moderately rapid permeability. Surface runoff is rapid. The surface layer has moderate organic matter content and is friable and easily worked.

Most areas of this soil are used for hay or pasture. Some areas are used for corn, soybeans, or small grain, and some are woodland. This soil has fair potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to small grain. Row crops can be grown occasionally. The hazard of erosion and runoff are the major limitations in the use of this soil for cultivated crops. Minimum tillage, crop rotations, crop residue management, diversions, and grassed waterways can be used to help control erosion and runoff, improve organic matter content, and maintain good tilth.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff and erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Erosion hazard and equipment limitations are moderate in the use of the soil for woods. Seedlings survive and grow well if competing vegetation is controlled by site preparation, and by spraying, cutting, or girdling. This soil is well suited to trees that have tap root systems. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. Use of some equipment in logging and planting is difficult because of the slope. Using specialized equipment and carefully planning logging and planting may help overcome this problem.

This soil has severe limitations for building sites because of slope. Grading the soil to modify the slope or designing buildings to complement the slope help overcome this limitation. This soil has severe limitations for septic tank absorption fields because of slope. Grading the soil of the filter field to modify the slope or installing absorption field on the contour help overcome the limitation. This soil has severe limitations for local roads and streets because of slope. Cuts and fills to modify the slope or designing roads and streets to fit the slope help overcome the limitation.

This soil is in capability subclass IVe and woodland suitability subclass 1r.

No—Nolin silt loam. This nearly level soil is deep and well drained. This soil is on flood plains along the White River. It is subject to frequent flooding. Individual areas of this unit are irrregular in shape and are dominantly 50 to 60 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is yellowish brown and brown, friable silt loam about 31 inches thick. The underlying material, to a depth of 60 inches, is brown silt loam. In some areas, the subsoil and underlying material is strongly acid or very strongly acid.

Included are small areas of gently sloping soils along drainageways and small areas of wetter soils in the base of drainageways and old sloughs. These inclusions make up about 5 to 10 percent of this unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easily tilled.

Most areas of the soil are used for growing corn, soybeans, and small grain. A few areas are used for hay and pasture or are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Frequent flooding is a hazard in the use and management of this soil. Flooding normally occurs before the major crops in the area are planted. Flooding can be controlled in some areas by installing levees and properly placed diversions to intercept runoff from higher ground. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help to improve and to maintain tilth and organic matter content of this soil.

This soil is suited to grasses and legumes for hay and pasture. Flood protection is necessary for high yields of grasses and legumes. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled by site preparation, spraying, cutting, or girdling.

This soil is severely limited for building sites and septic tank absorption fields and generally is not suited for these uses because of flooding. Areas used for these purposes must be protected from flooding. Installing levees and filling to elevate construction above the highest known flood level are ways of overcoming the flood problem. The soil has severe limitations for local roads and streets because of low strength and flooding. Fill is often needed to elevate the roadbed above the highest flood level and to provide sufficient drainage. The base needs strengthening with a more suitable material. Drainage is needed to lower the water table to reduce damage from frost action.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

OrD—Orthents, 6 to 25 percent slopes. These moderately sloping through moderately steep soils are deep and well drained. These soils are strip mined lands on the uplands, some of which have been partially leveled and some of which are still actively being worked. Depth to the coal dominantly ranged from 20 to 40 feet. The original soil material was 0 to 4 feet of loess over material weathered from sandstone, siltstone, and shale. The underlying bedrock consisted of stratified, acid sandstone and shale and neutral or mildly alkaline gray shale. Areas are irregular in shape and are dominantly 20 to 40 acres in size.

This soil is variable. Mostly, to a depth of 60 inches, the upper part is yellowish brown and strong brown, friable silt loam and silty clay loam; the next part is gray and light gray, mottled, firm shaly silty clay loam and silty clay; and the lower part is strong brown, mottled, firm, shaly silty clay loam to clay.

Included with this soil in mapping are vertical high walls and adjacent pits of water. Also included are small areas of soils that have slopes of less than 6 percent and areas of soils that are up to 35 percent channers and flagstones. Sanitary landfills are also included. Some areas are still being stripped and have not yet been graded or leveled.

This soil has moderate available water capacity and is moderately to slowly permeable. Surface runoff is rapid or very rapid. The surface layer has low organic matter content and is firm. The amount of rock fragments within the surface layer may interfere with normal tillage. Reaction of the surface layer ranges from neutral to very strongly acid and is quite variable.

Most areas of this soil are idle and have little vegetation; however, as this soil is graded and leveled, it will be seeded with grasses and legumes for hay and pasture. This soil has poor potential for agricultural crops and most engineering uses.

This soil is generally not suited to corn and soybeans. Runoff and erosion are the major hazards in the use of this land type for cultivated crops. Crop rotations of small grain with grasses and legumes help control runoff and erosion. Minimum tillage, contour farming, diversions, grassed waterways, or grade stabilization structures, crop residue management, and cover crops can be used to control erosion and runoff and to improve organic matter content and soil tilth.

This soil is suited to grasses and legumes for hay and pasture. Alfalfa and other deep rooted legumes are well suited to this soil. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive surface runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture in good condition.

This soil is suited to trees. It has moderate limitations for woodland because of slope and rapid and very rapid surface runoff. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling of unwanted trees and shrubs. Use of some equipment in logging and planting is difficult because of the slope. Using specialized equipment and carefully planning logging and planting may help overcome this problem.

This soil is severely limited for building sites because of high shrink-swell potential and slope. Locating on the less sloping parts of the unit, properly designing foundations and footings to prevent structural damage, and backfilling foundations with sand or gravel help overcome these limitations. Care must be taken to insure proper compaction for the footings. This soil has severe limitations for septic tank absorption fields because of slow permeability and slope. Increasing the size of the absorption field and installing on the contour help in correcting the limitations. A more suitable location should be considered. This soil has severe limitations for local roads and streets because of high shrink-swell potential and slope. Cuts and fills are needed, and the base material needs to be replaced with more suitable fill. The material below footings of road beds should be checked to insure proper compaction.

This soil is in capability subclass VIe and is not assigned to a woodland suitability subclass.

OtA—Otwell silt loam, 0 to 2 percent slopes. This nearly level soil is deep and well drained and moderately well drained. The soil is on loess-capped lake plains. It is on flat ridges between drainageways. Individual areas

are irregularly shaped and are dominantly 15 to 25 acres in size.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is yellowish brown and brownish yellow friable and firm silt loam and silty clay loam; the middle part is a very firm and brittle fragipan of brownish yellow and strong brown, mottled silty clay loam and loam; and the lower part is brown, mottled, stratified loam, sandy loam, and sandy clay loam. A few small areas of similar soils are on slopes of 2 to 6 percent.

Included with this soil in mapping are a few small areas of somewhat poorly drained Dubois soils, poorly drained Peoga soils, and well drained Pike soils. Dubois and Peoga soils are on broader flats between drainageways. Pike soils are on narrow points of convex ridges at slightly higher positions on the landscape. Also included are areas of soils where loess is over 48 inches deep, generally at higher positions. These inclusions make up about 10 to 15 percent of the unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easy to till. A seasonal water table is at a depth of 3.5 feet or more during the months of January through April. A very firm and brittle fragipan, at a depth of 22 to 36 inches, restricts the downward movement of roots.

Most areas of this soil are used for growing corn, soybeans, and small grain. A few areas are used for hay and pasture or are woodland. It has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Since the very slowly permeable fragipan restricts water movement, this soil is saturated during the winter and spring months, which causes delays in farming operations. This soil is somewhat droughty during long dry periods in the summer. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help improve and maintain the tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to alfalfa and other deep rooted legumes because it is wet and root growth is restricted by the fragipan. Overgrazing and grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing and restricted use during wet periods help keep the pasture and soil in good condition.

This soil has fair potential for growing trees. Seedling mortality and windthrow are hazards to the use of this soil for woods. The rooting zone is limited mainly to the area above the fragipan. Proper site preparation, selection of species, and spacing for seedlings help reduce seedling mortality. Prolonged seasonal wetness hinders logging and planting seedlings.

This soil is moderately limited for buiding sites because of moderate shrink-swell potential in the subsoil. Wetness is also a problem for houses with basements. Installing drains around foundations, backfilling with sand or gravel, and properly designing foundations and footings are ways to help overcome these limitations. This soil has severe limitations for septic tank absorption fields because of very slow permeability. Increasing the size of the absorption field helps overcome the limitation. Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of low strength and high frost action potential. The base materials need strengthening with more suitable material and adequate drainage along the road is needed to remove excess water.

This soil is in capability subclass IIw and woodland suitability subclass 3d.

OtB—Otwell silt loam, 2 to 6 percent slopes. This gently sloping soil is deep and well drained and moderately well drained. This soil is on loess-capped lake plains. It is on low ridges in flat areas and around the heads of drainageways. Individual areas are irregularly shaped and are dominantly 10 to 20 acres in size.

In a typical profile, the surface layer is brown silt loam about 9 inches thick. The subsoil, to a depth of about 80 inches, has this sequence of layers: The upper part is strong brown, firm silt loam; the middle part is a very firm and brittle fragipan of yellowish brown, mottled silt loam; and the lower part is strong brown, mottled, stratified loam, silt loam, and silty clay loam. A few small areas of similar soil have slopes of 0 to 2 percent or slopes of 6 to 12 percent.

Included with this soil is mapping are a few small areas of well drained Parke and Pike soils. Parke soils are sloping and around drainageways. Pike soils are on slightly higher parts of the landscape above the Otwell soil. Also included are small areas of Dubois soils, typically near the heads of drainageways, and soils where loess is over 48 inches deep, generally at higher positions on the landscape. These inclusions make up about 5 to 10 percent of the unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easy to till. A seasonal high water table is at a depth of 3.5 feet or more during the months of January through April. A very firm and brittle fragipan, at a depth of 22 to 36 inches, restricts the downward movement of roots. This frapigan in the subsoil restricts the movement of water so these soils are wet in winter and spring, which delays farming operations.

Most areas of this soil are used for growing corn, soybeans, and small grain. A few areas are used for hay

and pasture or are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Minimum tillage, contour farming, crop rotation, terraces, or grassed waterways help to prevent excessive soil loss. Since the very slowly permeable fragipan restricts water movement, this soil is often saturated in winter and spring. This causes delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help improve and maintain tilth and organic matter content of the soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to alfalfa and other deep rooted legumes because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Erosion and excessive runoff are hazards when pastures are overgrazed. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil has fair potential for growing trees. Seedling mortality and windthrow are hazards in the use of this soil for woods. The root zone is limited mainly to the area above the fragipan. Proper site preparation, selection of species, and proper spacing for seedlings help reduce seedling mortality.

This soil is moderately limited for building sites because of moderate shrink-swell potential in the subsoil. Wetness is also a problem for houses with basements. Foundations and footings should be designed to prevent structural damage caused by shrinking and swelling of the soil. Installing drains around foundation and backfilling with sand or gravel also help overcome these limitations. This soil has severe limitations for septic tank absorption fields because of very slow permeability. Increasing the size of the absorption field helps overcome the limitation. Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of high potential frost action and low strength. Strengthening of base material with more suitable fill and installing subsurface drains or open ditches along roadways to remove excess water from the freezing zone help overcome the limitations.

This soil is in capability subclass IIe and woodland suitability subclass 3d.

OtC2—Otwell silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and well drained and moderately well drained. This soil is on loess-capped lake plains. It is on side slopes along the drainageways. Individual areas are irregularly shaped and are dominantly 5 to 15 acres in size.

In a typical profile, the surface layer is brown silt loam that contains strong brown material from the subsoil. It is about 8 inches thick. The subsoil is about 44 inches thick. The upper part is strong brown, firm silty clay loam, and the lower part is a very firm and brittle fragipan of strong brown and brown mottled silt loam and loam. The underlying material, to a depth of 60 inches, is brown, mottled, stratified loam and sandy loam. There are a few small areas of similar soil that have slopes of 2 to 6 percent. In areas where erosion has occurred, the upper part of the subsoil has been mixed with the original surface layer by plowing, the present surface layer is strong brown silty clay loam and silt loam.

Included with this soil in mapping are a few small areas of well drained Parke soils and Otwell soils that are severely eroded. Parke soils are more sloping and are around drainageways below the Otwell soil. The severely eroded Otwell soils are intermixed with the eroded Otwell soil, generally on the upper parts of slopes. Also included are small areas of alluvial soils along the drainageways. Areas of soils where loess is over 48 inches deep, typically at higher elevations, are also included. These inclusions make up about 5 to 15 percent of this unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easy to till. A seasonal high water table is at a depth of 3.5 feet or more during the months of January through April. A very firm and brittle fragipan, at a depth of 22 to 36 inches, restricts the downward movement of roots. This fragipan in the subsoil restricts the movement of water so these soils are sometimes wet in winter and and spring, which delays farming operations.

Many areas of this soil are used for growing corn, soybeans, and small grain. Some areas are used for hay and pasture or are woodland. This soil has fair potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Minimum tillage, contour farming, crop rotations, terraces, diversions, and grassed waterways can be used to control erosion and runoff. Because the very slowly permeable fragipan restricts water movement this soil is often saturated in winter and spring, which causes delays in farming operations. This soil is somewhat droughty during long dry periods in the summer. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help improve and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to alfalfa and

other deep rooted legumes because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil has fair potential for growing trees. Seedling mortality and windthrow are hazards in the use of this soil for woods. The root zone is limited mainly to the area above the fragipan. Proper site preparation, selection of species, and proper spacing for seedling help reduce seedling mortality.

This soil is moderately limited for building sites because of slope and shrink-swell potential in the subsoil. Wetness is also a problem for houses with basements. Foundations and footings should be designed to prevent structural damage caused by shrinking and swelling of the soil. Grading the soil to modify the slope, installing drains around foundations, and backfilling with sand or gravel also help overcome these limitations. This soil has severe limitations for septic tank filter fields because of very slow permeability. Increasing the size of the absorption field area helps overcome the limitation. Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of high frost action potential and low strength. Strengthening of the base materials with a more suitable fill and installing open ditches along roadways to remove the excess water from the freezing zone help overcome the limitations.

This soil is in capability subclass IIIe and woodland suitability subclass 3d.

PaB—Parke silt loam, 2 to 6 percent slopes. This gently sloping soil is deep and well drained. This soil is on rolling, loess-capped lake plains. This soil is mostly around the heads and sides of drainageways and on a few, low, irregularly shaped ridges. Individual areas are irregularly shaped and dominantly 10 to 25 acres in size.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. The subsurface layer is yellowish brown silt loam about 3 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is strong brown, friable silty clay loam, and the lower part is brown and reddish brown, firm stratified sandy clay loam and sandy loam. A few small areas of these soils have slopes of less than 2 percent.

Included with this soil in mapping are a few small areas of well drained Pike soils mainly on slightly higher, more level positions of the landscape. Also included are small areas of well drained and moderately well drained Otwell soils, mainly near the heads of small drainageways. Small areas of Parke soils that have had most of the surface layer removed by erosion are also included. These inclusions make up about 5 to 10 percent of the map unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easy to work.

Most areas of this soil are used for growing corn, soybeans, and small grain. A few areas are used for hay or pasture or are woodland. This soil has good potential for agricultural crops and fair potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Erosion and runoff are the major hazards in the use of this soil for cultivated crops. Minimum tillage, crop rotations, contour farming, crop residue management, terraces, and grassed waterways help control erosion, improve organic matter content, and maintain good soil tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Some small areas have existing stands of native hardwoods. Plant competition is a moderate limitation to the use of this soil for woods. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap roots systems.

This soil has moderate limitations for building sites because of shrink-swell potential. Foundations and footings should be designed to prevent structural damage caused by shrinking and swelling of the soil. Backfilling foundations with sand or gravel also help overcome this limitation. This soil has slight limitations for septic tank absorption fields. It has severe limitations for local roads and streets because of potential frost action and low strength. Strengthening base material with more suitable fill and installing subsurface drains or open ditches along roadways to remove excess water help overcome these problems.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

PaC2—Parke silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and well drained. This soil is on rolling, loess-capped lake plains. This soil is mainly on the side slopes of drainageways. Individual areas are irregularly shaped and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is brown silt loam. It is about 9 inches thick, which contains yellowish brown material from the subsoil. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is strong brown, firm silty clay loam; the next part is brown,

friable loam; and the lower part is reddish brown, friable and firm sandy clay loam. A few small areas have slopes of less than 6 percent. In areas where erosion has occurred, the upper part of the subsoil has been mixed with the original surface layer by plowing so the present surface layer is strong brown silty clay loam and silt loam.

Included with this soil in mapping are a few small areas of well drained Pike soils that are mainly less sloping and well drained and moderately well drained Otwell soils. The Pike soils are adjacent to and between drainageways, and the Otwell soils are on side slopes of drainageways. Small areas of Parke soils that have lost all of the surface layer are mainly near the tops of slopes. Small areas of well drained Negley soils are on the ends of ridges and at the heads of drainageways. There are small wooded areas where little erosion of the soil has taken place. These inclusions make up about 10 to 15 percent of the map unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easy to work.

Most areas of this soil are used for growing corn, soybeans, and small grain. Some areas are used for hay and pasture, and some are woodland. This soil has fair potential for agricultural crops and most engineering uses.

This soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Minimum tillage, crop rotations, contour farming, crop residue management, terraces, diversions, and grassed waterways help control erosion and runoff, improve organic matter content, and maintain good soil tilth.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff and erosion. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. A few small areas have existing stands of native hardwoods. Plant competition is a moderate limitation in the use of this soil for woods. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap root systems.

This soil has moderate limitations for building sites because of slope and shrink-swell potential. Grading the soil to modify the slope or designing buildings to complement the slope help overcome the limitation of slope. Backfilling foundations with sand or gravel and properly designing foundations and footings to prevent structural damage caused by shrinking and swelling of the soil is needed. The soil has moderate limitations for septic tank absorption fields because of slope. Installing absorption fields on the contour or modifying the slope help overcome the problem. This soil has severe limitations for local roads and streets because of frost action potential and low stength. Strengthening the base materials with more suitable fill of higher strength and installing subsurface drains or open ditches along roadways to remove excess water help overcome these problems.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

PaD3—Parke silt loam, 12 to 18 percent slopes, severely eroded. This strongly sloping soil is deep and well drained. This soil is on rolling, loess-capped lake plains. It is on terrace breaks and side slopes along drainageways. Individual areas are irregularly shaped and are dominantly 5 to 15 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil is about 54 inches thick. The upper part is strong brown, firm silty clay loam; the middle part is yellowish red, firm sandy clay loam; and the lower part is yellowish red, friable stratified loam and sandy loam. The underlying material, to a depth of 66 inches, is yellowish red, loose loamy sand. There are a few small areas of soils that have slopes of less than 12 percent. In many areas the surface layer is strong brown silty clay loam, because the original has been eroded away. Areas of this soil that has a thicker surface layer are mainly on the lower part of the slope.

Included with this soil in mapping are a few small areas of well drained Negley soils that have mainly short steep slopes and are below the Parke soils. Also included are areas of well drained Otwell soils, which are mainly on side slopes of drainageways, and areas of alluvial soils along drainageways. These inclusions make up about 15 to 20 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is very rapid. The surface layer has low organic matter content and is friable and easy to work.

Most of this soil is used for hay and pasture. A few areas are used for growing corn, soybeans, and small grain, and a few areas are poor stands of woodland. This soil has poor potential for agricultural crops and most engineering uses.

This soil is generally not suited to corn, soybeans, and small grain. Runoff and erosion are the major hazards in the use of this soil for cultivated crops.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, excessive runoff and erosion and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. A few areas have existing stands of native hardwoods. Plant competition is a mod-

erate limitation to the use of this soil for woods. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap root systems.

This soil has severe limitations for building sites because of slope. Grading the soil to modify the slope or designing a building to complement the slope help in overcoming the limitation. This soil has severe limitations for septic tank absorption fields because of slope. Developing installations on the contour, modifying the slope, or picking an alternate site on one of the less sloping included soils help in overcoming the limitation. This soil has severe limitations for local roads and streets because of slope, low strength and frost action potential. Cutting and filling, locating on less sloping inclusions, and placing subsurface drains or open ditches along roadways to remove excess water help overcome these limitations. The road base needs strengthening with a more suitable material.

This soil is in capability subclass VIe and woodland suitability subclass 1o.

PeB—Pekin silt loam, 2 to 6 percent slopes. This gently sloping soil is deep and moderately well drained. This soil is on stream terraces. It is rarely flooded. Individual areas are irregular in shape and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is dark brown silt loam about 8 inches thick. The subsoil is about 7 inches thick. The upper part is yellowish brown, mottled, friable silt loam; the next part is pale brown, mottled, friable silty clay loam; the next part is a very firm fragipan of yellowish brown, mottled clay loam; and the lower part is brownish yellow, mottled, friable silt loam. The underlying material to a depth of 70 inches is brownish yellow, mottled silty clay loam. Small areas of this soil have slopes of greater than 6 percent.

Included with this soil in mapping are small areas of well drained soils without a fragipan, mainly on narrow ridges and near terraces breaks. Also included are small areas of somewhat poorly drained Bartle soils that are mainly more nearly level or are at the heads of drainageways. There are small areas of the Pekin soil near the top of the slope, where erosion has removed most or all of the surface layer. These inclusions make up 5 to 20 percent of this unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easily tilled. A seasonal high water table is at a depth of 2 to 6 feet during the months of March and April. A very firm and brittle fragipan, at a depth of 24 to 36 inches, restricts the downward movement of roots.

Most areas of this soil are used for growing corn, soybeans, and small grain. Many areas are used for hay and pasture, and some areas are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Crop rotation, minimum tillage, terraces, contour farming, or grassed waterways help prevent excessive soil loss. Because the very slowly permeable fragipan restricts water movement, this soil is often saturated in winter and spring, which causes delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. The use of crop residue, cover crops, and green manure crops help to control erosion and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to deep rooted legumes, such as alfalfa, because the fragipan restricts the depth to which roots can penetrate. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. The rooting zone is limited mainly to the area above the fragipan and fair production can be expected.

This soil is severely limited for building sites. Most of this soil is rarely flooded. Filling to elevate construction above the highest known flood level, and installing adequate drainage to lower the seasonal high water table is needed. This soil has severe limitations for septic tank absorption fields because of the seasonal high water table and very slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the water table help to correct this limitation. Central sanitary sewers are usually needed because these limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of potential frost action. Drainage should be installed to lower the water table. This removes water from the freezing zone so that frost action can be reduced.

This soil is in capability subclass IIe and woodland suitability subclass 3o.

PeC2—Pekin silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and moderately well drained. This soil is on stream terraces. It is rarely flooded. Individual areas are irregular in shape and are dominantly 5 to 10 acres in size.

In a typical profile, the surface layer is dark brown silt loam that contains yellowish brown material from the subsoil. It is about 7 inches thick. The subsoil is about 38 inches thick. The upper part is yellowish brown, mottled, friable silt loam and the lower part is a very firm fragipan of yellowish brown, mottled silty clay loam. The

underlying material, to a depth of 70 inches, is yellowish brown, mottled stratified silty clay loam and silt loam. In areas where erosion has occurred, the upper part of the subsoil has been mixed with the original surface layer by plowing and the present surface layer is yellowish brown silt loam.

Included with this soil in mapping are small areas of well drained soils without a fragipan, mainly on side slopes of terrace breaks and drainageways. Also included are small areas of the Pekin soil that has lost all of the surface layer, mainly on short breaks where slopes are more than 12 percent. Small areas of alluvial soils are along drainageways. These inclusions make up about 2 to 10 percent of this unit.

This soil has moderate available water capacity and is very slowly permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easily tilled. A seasonal high water table is at a depth of 2 to 6 feet during the months of March and April. A very firm and brittle fragipan, at a depth of 24 to 36 inches, restricts the downward movement of roots.

Most of this soil is used for growing corn, soybeans, and small grain. Many areas are used for hay and pasture, and some areas are woodland. This soil has fair potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff when cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or installing grade stabilization structures can be used to help control erosion and runoff. Because the very slowly permeable fragipan restricts water movement, these soils are often saturated in winter and spring, which causes delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. The use of crop residue and cover crops also help control erosion and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to deep rooted legumes, such as alfalfa, because the fragipan restricts the depth to which roots can penetrate. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The rooting zone is limited mainly to the area above the fragipan and fair production can be expected.

This soil is severely limited for building sites. It is subject to flooding on rare occasions. Filling to elevate construction above the highest known flood level, and installing adequate drainage to lower the seasonal high water table is needed. This soil has severe limitations for septic tank absorption fields because of the seasonal high water table and very slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the seasonal water table help correct this limitation. Central sanitary sewer systems are usually needed because these limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of potential frost action. Drainage should be installed to lower the water table. This removes water from the freezing zone so that frost action can be reduced.

This soil is in capability subclass IIIe and woodland suitability subclass 3o.

Pg—Peoga silt loam. This nearly level soil is deep and poorly drained. This soil is on loess-capped lake plains and low alluvial terraces. It is in flat, slightly depressional areas between drainageways. Individual areas are irregularly shaped and are dominantly 60 to 80 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 11 inches thick. The subsurface layer is gray, mottled silt loam about 7 inches thick. The subsoil, to a depth of 80 inches, has the following sequence: The upper part is light brownish gray, mottled, friable and firm silt loam and silty clay loam; the next part is a very firm fragipan of gray, mottled silt loam and yellowish brown, mottled loam; and the lower part is strong brown, friable, stratified sandy loam and sandy clay loam. In some areas the lower part of the subsoil is very firm and brittle. In a few areas a similar soil has slopes of about 3 percent.

Included with this soil in mapping are a few small areas of Bartle soils and Dubois soils. The Bartle soils are on low alluvial terraces, and the Dubois soils are on lake plains. These soils are on slightly higher knolls and on flats near drainageways. Also included are small areas of dark colored clayey soils in slight depressions. These inclusions make up about 5 to 10 percent of the unit.

This soil has high available water capacity and is slowly permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easy to till. Depth to a seasonal high water table ranges from 0 to 1 foot below the surface during the months of January through May. The seasonal high water table keeps this soil saturated in the winter and spring, which delays farming operations.

Most areas of this soil are used for growing corn (fig. 7), soybeans, and small grain. A few areas are used for hay and pasture or are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to corn, soybeans, and small grain if a suitable drianage system is established and maintained. Wetness is a limitation for use of this soil for crops. Excess water can be removed by installing open ditches, subsurface drains, surface drains, or a combina-

Figure 7.—Peoga silt loam is suited to growing corn, soybeans, and small grain if it is adequately drained.

tion of these. If properly drained and managed, this soil is suited to intensive row cropping. Minimum tillage and returning crop residue to the soil help improve and maintain tilth and organic matter content.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. Alfalfa and other deep rooted legumes are not suited to this soil because of the seasonal high water table. Drainage is necessary to obtain high yields of forage and to maintain the pasture in good condition. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rate, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Equipment limitation and seedling mortality are severe and windthrow hazard is moderate in the use of this soil for woods. The high water table limits harvesting and planting to dry seasons or to seasons when the ground is frozen. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling of unwanted trees and shrubs. Water-tolerant species should be favored in timber stands.

This soil is severely limited for building sites because of a seasonal high water table. It is difficult to drain most areas of this soil because it is often in the lowest lying part of the landscape and is some distance from an adequate outlet. Installing peripheral subsurface drains and surface drains and grading down to an outlet, such as a storm drain, are means of controlling the water table and surface runoff. This soil has severe limitations for septic tank absorption fields because of wetness and the slowly permeable subsoil. Draining the area and increasing the size of the septic tank absorption field or, if available, connecting into commercial sanitary sewer systems are means of overcoming the wetness. This soil has severe limitations for local roads and streets because of wetness, frost action, and low strength. Stengthening base material with more suitable fill and installing subsurface drains or open ditches along roadways to remove excess water from the freezing zone help in overcoming the limitations.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

Ph—Petrolia silty clay loam. This nearly level soil is deep and poorly drained soils. This soil is on flood plains and is subject to frequent flooding. It is in depressions and old sloughs of the flood plains. Individual areas are irregularly shaped and are dominantly 30 to 40 acres in size.

In a typical profile, the surface layer is dark grayish brown silty clay loam about 11 inches thick. The underlying material, to a depth of 60 inches, is gray, mottled

silty clay loam. In some areas, the underlying material contains thin strata of silt loam, clay loam, sandy loam, or loam. In some places soils have a strongly acid or very strongly acid underlying material or have a silt loam surface layer.

Included are small areas of mucky soils and marshy soils. These inclusions make up about 5 percent of the unit.

This soil has a high available water capacity and is moderately slowly permeable. Surface runoff is very slow or the soil is ponded. The surface layer has moderate organic matter content and is difficult to work. If tilled when too wet, it becomes cloddy and makes preparation of a seedbed difficult. Reaction of the surface layer is usually slightly acid or neutral. Depth to a seasonal high water table ranges from 0 to 3 feet below the surface during the months of January through June.

Most areas of this soil are used for growing corn and soybeans. A few areas are used for growing small grain or are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain if a suitable drainage system is established and maintained. Wetness is a limitation and flooding a hazard in the use and management of this soil. Flooding normally occurs before the major crops in the county are planted. Subsurface drains and open ditches are used to lower the water table. Flooding can be controlled in some areas by levees and properly placed diversions to intercept runoff from higher ground. Minimum tillage, returning crop residue to the soil, and using green manure crops helps to improve and maintain organic matter content and good tilth.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. Alfalfa and other deep rooted legumes are not suited to this soil because of the high water table. Drainage and flood protection are necessary to attain high yields of grasses and legumes. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Equipment limitation and seedling mortality are moderate in the use of this soil for woods. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation, spraying, cutting, or girdling. Prolonged seasonal wetness limits harvesting and planting to dry seasons or seasons when the ground is frozen. Water-tolerant species are favored in timber stands.

This soil is severely limited for building sites and septic tank absorption fields and generally is not suited to these uses, because it has a seasonal high water table and is subject to frequent flooding. Areas used for these purposes must be drained and protected from flooding. Installing levees and filling to elevate the construction above the highest known flood level are ways of overcoming the flood hazard. This soil has severe limitations for local roads and streets because of low strength, a seasonal high water table, and flooding. Drainage is needed to lower the water table and to remove water from the freezing zone so that frost action can be reduced. Fill is often needed to elevate the roadbed above the highest flood level and to provide sufficient strength and drainage in the soil.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

PkA—Pike silt loam, 0 to 2 percent slopes. This nearly level soil is deep and well drained. This soil is on broad, flat, loess-capped lake plains. It is in broad and slightly convex areas between the drainageways. Individual areas are irregularly shaped and are dominantly 60 to 80 acres in size.

In a typical profile the surface layer is brown silt loam about 10 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is strong brown, firm silty clay loam; the next part is strong brown, friable silt loam; and the lower part is red, firm sandy clay loam.

Included with this soil in mapping are a few small areas of well drained and moderately well drained Otwell soils and well drained Parke soils. Otwell soils are adjacent to Pike soils or at slightly higher elevations in individual areas of this map unit. The Parke soils are around drainageways and generally have slopes of 2 to 4 percent. These inclusions make up about 5 to 10 percent of the unit.

This soil has a high available water capacity and is moderately permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easy to work.

Most areas of this soil are used for growing corn, soybeans, and small grain. A few areas are used for hay or pasture or are woodland. This soil has good potential for agricultural crops and most engineering uses.

This soil is well suited for growing corn, soybeans, and small grain. Minimum tillage, returning crop residue to the soil, and using green manure crops can be used to improve organic matter content and maintain good soil tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Some small areas have existing stands of native hardwoods. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or gir-

dling of unwanted trees and shrubs. This soil is very well suited to trees that have tap root systems.

This soil is slightly limited for building sites and septic tank absorption fields. It has severe limitations for local roads and streets because of high potential for frost action and low strength. Strengthening base material with a more suitable fill and installing open ditches along roadways to remove excess water from the freezing zone help in overcoming the limitations.

This soil is in capability class I and woodland suitability subclass 1o.

PkB—Pike silt loam, 2 to 6 percent slopes. This gently sloping soil is deep and well drained. This soil is on rolling, loess-capped lake plains. It is on low, irregularly shaped ridges and around the heads of drainageways. Individual areas are longer than they are wide and irregularly shaped and are dominantly 10 to 30 acres in size.

In a typical profile, the surface layer is brown silt loam about 8 inches thick. The subsoil, to a depth of 80 inches, has this sequence of layers: The upper part is strong brown, firm silty clay loam and the lower part is red, firm sandy clay loam. There are areas of a similar soil on the ridgetops where slopes are 0 to 2 percent.

Included with this soil in mapping are a few small areas of well drained and moderately well drained Otwell soils. Otwell soils are adjacent to Pike soils or are at slightly higher elevations in individual areas of this map unit. Also included are small areas of the Pike soil that has a thinner surface layer because of erosion. These inclusions make up about 5 to 10 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is medium. The surface layer has moderate organic matter content surface and is friable and easy to work.

Most areas of this soil are used for growing corn, soybeans, and small grain. A few areas are used for hay or pasture or are woodland. This soil has good potential for agricultural crops and most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Erosion and runoff are the major hazards in the use of this soil for cultivated crops. Minimum tillage, crop rotations, contouring, crop residue management, terraces, and grassed waterways help to control erosion, improve organic matter content, and maintain good soil tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Some small areas have existing stands of native hardwoods. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap root systems.

This soil is slightly limited for building sites and septic tank absorption fields. It has severe limitations for local roads and streets because of high potential for frost action and low strength. Strengthening of the base material with a more suitable fill and installing open ditches along roadways to remove excess water from the freezing zone help in overcoming the limitations.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

PrB—Princeton fine sandy loam, 2 to 6 percent slopes. This gently sloping soil is deep, and well drained. This soil is on rolling uplands. It is typically on ridgetops. Individual areas are irregularly shaped and dominantly 30 to 40 acres in size.

In a typical profile, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsoil is about 40 inches thick. The upper part is strong brown and yellowish red, friable loam; the middle part is yellowish red, firm sandy clay loam; and the lower part is yellowish red and strong brown, friable and very friable fine sandy loam. The underlying material, to a depth of 60 inches, is strong brown loamy fine sand. There are few areas that have slopes of less than 2 percent.

Included with this soil in mapping are a few small areas of the Princeton soil that has slopes of more than 6 percent. They are mainly on side slopes adjacent to drainageways. Also included are small areas of wet soils in slight depressions. In some areas the soil is up to 20 inches of loamy fine sand over the finer textured subsoil. These inclusions make up about 5 to 15 percent of the unit.

This soil has moderate available water capacity and is moderately permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is very friable and easy to work.

Most areas of this soil are used for growing corn, soybeans, and small grain. A few areas are used for hay or pasture or are woodland. This soil has good potential for agricultural crops and most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard in the use of this soil for cultivated crops. The moderate available water capacity is a limitation. During years of below average or poorly distributed rainfall, crops are subject to damage from drought. Minimum tillage, crop rotations, crop residue management, terraces, diversions, and grassed waterways can be used to control erosion and to improve organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing should be avoided. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Some small areas have existing stands of native hardwoods. Plant competition is a moderate limitation to the use of this soil for woods. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap root systems.

This soil has slight limitations for building sites and septic tank absorption fields. It has moderate limitations for local roads and streets because of moderate potential for frost action. Installing subsurface drains or open ditches along the road to remove excess water from the freezing zone help overcome the limitation.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

PrC—Princeton fine sandy loam, 6 to 12 percent slopes. This moderately sloping soil is deep and well drained. This soil is on rolling uplands. It is typically on ridgetops. Individual areas are irregularly shaped and dominantly 20 to 30 acres in size.

In a typical profile, the surface layer is brown fine sandy loam about 10 inches thick. The subsoil is about 43 inches thick. The upper part is dark brown, friable fine sandy loam; the next part is dark brown, firm sandy clay loam; the next part is dark brown, very friable fine sandy loam; and the lower part is dark yellowish brown, loose loamy fine sand. The underlying material, to a depth of 80 inches, is brown, loose fine sand and loamy fine sand. There are a few small areas of this soil that have slopes of less than 6 percent. In some areas the steeper Princeton soil has a thinner surface layer because of erosion.

Included with this soil in mapping are a few small areas of the Princeton soil that has slopes of more than 12 percent, mainly on side slopes adjacent to drainageways. Also included are small areas of well drained Alford soils, mainly on narrow ridgetops. In some areas soils have up to 20 inches of loamy fine sand over the finer textured subsoil. These inclusions make up about 5 to 10 percent of the unit.

This soil has moderate available water capacity and is moderately permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is very friable and easy to work.

Most of this soil is used for growing corn, soybeans, and small grain. Some areas are used for hay or pasture or are woodland. This soil has fair potential for agricultural crops and most engineering uses.

This soil is suited to corn, soybeans, and small grain. Erosion and runoff are the major hazards in the use of this soil for cultivated crops. The moderate available water capacity is a limitation. During years of below average or poorly distributed rainfall, crops are subject to damage from drought. Minimum tillage, crop rotations, crop residue management, terraces, diversions, and grassed waterways can be used to control erosion and runoff, improve organic matter content, and maintain good soil tilth.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing should be avoided. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. A few small areas have existing stands of native hardwoods. Plant competition is a moderate limitation to the use of this soil for woods. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling of unwanted trees and shrubs. This soil is well suited to trees that have tap root systems.

This soil is moderately limited for building sites because of slope. Grading the soil to modify the slope or designing buildings to fit the slope help overcome the limitation. It has moderate limitations for septic tank absorption fields because of slope. Developing installations on the contour or modifying the slope help overcome the problem. This soil has moderate limitations for local roads and streets because of potential frost action and slope. Cutting and filling to modify the slope and installing subsurface drains or open ditches along roadways to remove excess water from the freezing zone help overcome these problems.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

PrF—Princeton fine sandy loam, 20 to 60 percent slopes. This steep soil is deep and well drained. This soil is on side slopes and is on uplands. Individual areas are irregularly shaped and are dominantly 30 to 40 acres in size.

In a typical profile, the surface layer is brown fine sandy loam about 6 inches thick. The subsoil is about 24 inches thick. The upper part is dark brown, friable fine sandy loam; the middle part is dark brown, friable sandy loam; the lower part is dark brown, firm sandy clay loam. The underlying material, to a depth of 80 inches, is light yellowish brown fine sand and very fine sand. In some areas that were cleared for pasture, most of the surface layer has been removed by erosion.

Included with this soil in mapping are a few small areas of this Princeton soil that has slopes of more than 60 percent. There are soils on the lower slopes that have a thicker surface layer and areas of alluvial soils along drainageways. Also included are small areas of well drained Alford soils that are mixed throughout the unit. There are a few small areas of soils that are more sand throughout and soils that are as much as 30 inches of loamy sand over the finer textured subsoil. These inclusions make up about 5 to 15 percent of the unit.

This soil has moderate available water capacity and is moderately permeable. Surface runoff is rapid. The surface layer has moderate organic matter content and is

very friable and easy to work. Steepness of slope makes tillage difficult.

Most areas of this soil are woodland. Some areas are used for pasture. This soil has poor potential for agricultural crops and most engineering uses.

This soil is not suited to such cultivated crops as corn, soybeans, and small grain because of steepness of slope, runoff, and erosion hazards.

This soil is poorly suited to grasses and legumes for pasture. In years when rainfall is below average or poorly distributed, pasture growth may be poor because of damage from drought. Overgrazing should be avoided. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees and most areas have existing stands of native hardwoods. Erosion hazards and equipment limitations are severe in the use of this soil for woods. Selective cutting rather than clear cutting, placing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. Use of some equipment in logging and planting is difficult because of slope. Using specialized equipment and carefully planning logging and planting may help overcome this problem.

This soil has severe limitations for building sites, septic tank absorption fields, and local roads and streets because of slope. Grading the soil to modify the slope or designing buildings to complement the slope may help in overcoming the limitation. An alternate site on more suitable soils should be considered for these uses.

This soil is in capability subclass VIIe and woodland suitability subclass 1r.

Sf—Steff silt loam. This nearly level soil is deep and moderately well drained. This soil is on the flood plains. It is subject to frequent flooding. Individual areas of this unit are irregular in shape and are dominantly 40 to 60 acres in size.

In a typical profile, the surface layer is brown silt loam about 11 inches thick. The subsoil is about 39 inches thick. The upper part is yellowish brown, mottled, friable silt loam, and the lower part is pale brown and light brownish gray, mottled, friable silt loam. The underlying material, to a depth of 70 inches, is acid. It is light brownish gray, pale brown, and dark brown that is mottled and friable. In some places the surface layer is lighter colored. Also, in some areas the soil has a higher content of sand in the surface layer and subsoil. In small areas this soil has a medium acid to neutral subsoil.

Included with this soil in mapping are small areas of somewhat poorly drained Stendal soils and well drained Cuba soils. Stendal soils are in flat or depressional areas. Cuba soils are on slightly higher positions of the landscape or are adjacent to drainageways. Also included are small areas of gently sloping soils along drainageways. These inclusions make up about 5 to 15 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 1.5 to 3 feet during the months of December through April.

Most areas of this soil are used for growing corn, soybeans, or small grain. A few areas are used for hay and pasture or are woodland. It has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and some small grain. Flooding is a hazard in the use and management of this soil but normally occurs before the major crops in the area are planted. Flooding can be controlled in some areas by installing levees and properly placing diversions to intercept runoff from higher ground. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help to improve and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and spraying, cutting, or girdling of unwanted trees and shrubs.

This soil is severely limited for building sites and septic tank absorption fields and generally is not suited to these uses, because it has a seasonal high water table and is subject to flooding. Areas used for these purposes must be drained and protected from flooding. Installing levees and filling to elevate the construction above the highest known flood level are ways of overcoming the flood hazard. This soil has severe limitations for local roads and streets because of flooding. Drainage is needed to lower the water table and fill is often needed to elevate the roadbed above the flood level and to provide sufficient drainage.

This soil is in capability subclass IIw and woodland suitability subclass 1o.

St—Stendal silt loam. This nearly level soil is deep and somewhat poorly drained. This soil is on flood plains. It is subject to frequent flooding. Individual areas of this unit are irregular in shape and are dominantly 100 to 115 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam about 10 inches thick. Between 10 and 53 inches, the underlying material is light brownish gray, pale brown, and light gray, silt loam that is mottled and

friable. Below this, to a depth of 60 inches, is gray and light gray, mottled, friable silt loam and loam. In some places, this soil has a high content of sand in the surface and subsoil. Also, there are areas of light colored alluvium that is 8 to 12 inches deep to dark colored alluvium. Small areas of this soil that is medium acid to neutral are also included.

Included with this soil in mapping are small areas of poorly drained Bonnie and moderately well drained Steff soils. The Bonnie soils are in slightly depressional areas and the Steff soils are at slightly higher positions of the landscape. Also included are small areas of mucky soils and small areas of gently sloping soils along drainageways. These inclusions make up about 5 to 15 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is slow. The surface layer has low organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 1 to 3 feet during the months of January through April.

Most areas of this soil are used for growing corn, soybeans, and small grain. A few areas are used for hay and pasture or are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn (fig. 8), soybeans, and small grain if adequately drained. Wetness is a limitation and frequent overflow is a hazard in the use and management of this soil. Flooding normally occurs before the major crops in the area are planted. Subsurface drainage and open ditches can be used to lower the water table. Flooding can be controlled in some areas by installing levees and properly placing diversions to intercept runoff from higher ground. Minimum tillage, returning crop residue to the soil, and using cover crops and green manure crops help to improve and to maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. Alfalfa and other deep rooted legumes are not suited to this soil because of the high water table. Drainage and protection from flooding is necessary for high yields of grasses and legumes. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods keep the pasture and soil in good condition.

This soil is suited to trees. Equipment limitation is moderate in the use of this soil for woods. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and spraying, cutting, or girdling of unwanted trees and shrubs. The high water table delays harvesting and planting to dry seasons or to seasons when the ground is frozen.

This soil is severely limited for building sites and septic tank absorption fields and generally is not suited to these uses, because it has a seasonal high water table and is subject to frequent flooding. Areas used for these purposes must be drained and protected from flooding. Installing levees and filling to elevate the construction above the highest known flood level are ways of overcoming the flood hazard. This soil has severe limitations for local roads and streets because of frost action and flooding. Drainage is often needed to lower the water table. Fill to elevate the roadbed above the highest flood level and to provide sufficient drainage and protection from flooding.

Figure 8.—Most areas of Stendal silt loam have been drained and are used for growing corn, soybeans, and small grain.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

TIA—Tilsit silt loam, 0 to 2 percent slopes. This nearly level soil is deep and moderately well drained. This soil is on ridgetops and is on the uplands. Individual areas of this unit are irregular in shape and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 12 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, firm silty clay loam; the middle part is a very firm fragipan of yellowish brown silt loam; and the lower part is yellowish brown, friable silt loam. Sandstone and shale bedrock is at a depth of about 62 inches. There are also small areas of this soil where slopes are more than 2 percent.

Included with this soil in mapping are small areas of somewhat poorly drained Johnsburg soils in slightly depressional areas. This inclusion makes up about 5 to 10 percent of the unit.

This soil has moderate available water capacity and is slowly permeable. Surface runoff is slow. The surface layer has moderate organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 1.5 to 2.5 feet during the months of January through April. A very firm and brittle fragipan, at a depth of 20 to 28 inches, restricts the downward movement of roots.

Most areas of this soil are used for growing corn, soybeans, and small grain. Many areas are used for hay and pasture, and some areas are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Since the slowly permeable or very slowly permeable fragipan restricts water movement, this soil is often saturated in the winter and spring months, which causes delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. Minimum tillage, returning crop residue to the soil, and using cover crops and green manures help improve and maintain organic matter content and good tilth.

This soil is suited tc grasses and shallow rooted legumes for hay and pasture. It is not suited to deep rooted legumes, such as alfalfa, because the fragipan restricts the depth to which roots can penetrate. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The rooting zone is limited mainly to the area above the fragipan and fair production can be expected.

This soil is moderately limited for most building sites. The seasonal high water table is the main limitation. Buildings should be built without basements, and drains should be installed around foundations to help remove excess water. This soil has severe limitations for septic tank absorption fields because of the seasonal high water table and slow or very slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the water table help correct this limitation. Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for roads and streets because of low strength. The base materials need strengthening with more suitable material. Drainage should be installed to lower the water table and to remove water from the freezing zone so that frost action can be reduced.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

TlB—Tilsit silt loam, 2 to 6 percent slopes. This gently sloping soil is deep and moderately well drained. This soil is on ridgetops and is on the uplands. Individual areas are irregular in shape and are dominantly 25 to 35 acres in size.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 52 inches thick. The upper part is yellowish brown, friable silt loam; the next part is yellowish brown, mottled, firm silty clay loam; the next part is a very firm fragipan of yellowish brown, mottled, silty clay loam; and the lower part is yellowish brown, friable silt loam. The underlying material, to a depth of 72 inches, is brownish yellow, mottled, stratified channery loam, silt loam, and silty clay loam. Sandstone and shale bedrock is at a depth of 72 inches. There are also small areas of this soil where slopes are more than 6 percent.

Included with this soil in mapping are a few small areas of somewhat poorly drained Johnsburg soils in more nearly level or slightly depressional areas. This inclusion makes up about 5 to 8 percent of the unit.

This soil has moderate available water capacity and is slowly permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and is easily tilled. Depth to a seasonal high water table ranges from 1.5 to 2.5 feet during the months of January through April. A very firm and brittle fragipan, at a depth of 20 to 28 inches, restricts the downward movement of roots.

Most areas of this soil are used for growing corn, soybeans, and small grain. Many areas are used for hay and pasture, and some areas are woodland. This soil has good potential for agricultural crops and poor potential for most engineering uses.

This soil is well suited to corn, soybeans, and small grain. Measures that control erosion and surface runoff are needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, contour farming, or grassed waterways help prevent excessive soil loss. Because the very slowly permeable fragipan restricts water movement, these soils are often saturated in winter and spring, which causes delay in farming operations. This soil is somewhat droughty during long dry periods in the summer. Crop residue management and using cover crops and green manure crops help to control erosion and to maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to deep rooted legumes, such as alfalfa, because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The rooting zone is limited mainly to the area above the fragipan and fair production can be expected.

This soil is moderately limited for most building sites. The seasonal high water table is the main limitation. Buildings should be constructed without basements and drains should be installed around foundations to help correct this limitation. This soil has severe limitations for septic tank absorption fields because of the seasonal high water table and slow or very slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the water table help correct this limitation. Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of low strength. The base materials need strengthening with more suitable material. Drainage should be installed to lower the water table and to remove water from the freezing zone so that frost action can be reduced.

This soil is in capability subclass IIe and woodland suitability subclass 3o.

WeC2—Wellston silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and is well drained. This soil is on narrow ridgetops and side slopes along natural drainageways. Individual areas are typically narrow and irregular in shape and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is brown silt loam that contains strong brown material from the subsoil. It is about 7 inches thick. The subsoil is about 36 inches thick. The upper part is strong brown, firm silty clay loam, and the lower part is yellowish brown, friable silt loam and loam. Rippable sandstone bedrock is at a depth of about 43 inches. In a few small areas this soil has a thicker surface layer. In areas where erosion has occurred, the upper part of the subsoil has been mixed with the original surface layer by plowing and the present surface layer is yellowish brown silt loam.

Included with this soil in mapping are small areas of well drained Zanesville soils, mainly on wider ridgetops. Also included are a few small areas of steeper Gilpin and Wellston soils along drainageways. Small areas of alluvial soils are along the drainageways. Also included are areas of soils, mainly near the tops of slopes, which have lost most of the surface layer. Small areas of Alford soils are on ridgetops adjacent to the White River. These inclusions make up about 5 to 15 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easily tilled.

Most areas of this soil are used for hay, pasture, or woods. A few areas are farmed and used for growing corn, soybeans, and small grain. This soil has fair potential for agricultural crops and most engineering uses.

This soil is suited to corn, soybeans, and small grain. Measures that control erosion and surface runoff are needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help control erosion and runoff. Proper use of crop residue and cover crops also help control erosion and improve and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing pastures causes surface compaction, excessive runoff, poor tilth, and reduced density of plant growth. Proper stocking rates and pasture rotation keep the pasture and soil in good condition.

This soil is suited to trees and good production can be expected. Plant competition is a moderate hazard. Unwanted trees and shrubs can be controlled and removed by spraying, cutting, or girdling.

This soil is moderately limited for building sites. The slope and the depth to rock are the main limitations. The soil needs to be graded to modify the slope or the building needs to be designed to fit the slope. This soil has moderate limitations for septic tank absorption fields because of slope, permeability, and depth to rock. Designing the field to work properly on the slope, increasing the size of the filter field, or grading the soil to modify the slope helps correct this limitation. This soil has severe limitations for local roads and streets because of frost action. Installing adequate drainage along roadways to remove excess water helps overcome this limitation.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

WeC3—Wellston silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping soil is deep and well drained. This soil is on narrow ridgetops and side slopes along natural drainageways. Individual areas are usually narrow and irregular in shape and are dominantly 10 to 15 acres in size.

In a typical profile, the surface layer is dark yellowish brown silt loam about 4 inches thick. The subsoil is about 36 inches thick. The upper part is strong brown, firm silty clay loam, and the lower part is yellowish brown, friable silt loam and loam. Rippable sandstone bedrock is at a depth of about 40 inches. In many areas the surface layer is strong brown silty clay loam.

Included with this soil in mapping are small areas of well drained Zanesville soils, mainly on wider ridgetops. Also included are areas of steeper Gilpin and Wellston soils along drainageways. Also included are small areas of gullied soils mainly on the upper parts of slopes, and areas, mainly on the lower slopes, where the soil has a thicker surface layer. Small areas of alluvial soils are along the drainageways, and small areas of Alford soils, on ridgetops, are adjacent to the White River. These inclusions make up 5 to 15 percent of the unit.

This soil has high available water capacity and is moderately permeable. Surface runoff is rapid. The surface

layer has low organic matter content. It is often difficult to till because of the amount of subsoil mixed with it.

Most areas of this soil are used for growing corn, soybeans, and small grain. Some areas are used for hay and pasture, and a few are woodland. This soil has fair potential for agricultural crops and most engineering uses.

This soil is suited to small grain. Row crops can be grown occasionally. Measures that control erosion and surface runoff are needed. Crop rotation, minimum tillage, diversions, contour farming, or grassed waterways help control erosion and runoff. The use of crop residue and cover crops also help to control erosion and to improve tilth and organic matter content of this soil.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is too wet causes surface compaction, poor tilth, excessive runoff, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is a moderate hazard. Unwanted trees and shrubs can be controlled and removed by spraying, cutting, or girdling.

This soil has moderate limitations for building sites. The slope and the depth to bedrock are the main limitations. The soil needs to be graded to modify the slope or the building needs to be designed to fit the slope. This soil has moderate limitations for septic tank absorption fields because of slope, permeability, and depth to bedrock. Designing the field to work properly on the slope, increasing the size of the filter field, or grading the soil to modify the slope helps correct this limitation. This soil has severe limitations for local roads and streets because of frost action. Installing adequate drainage along roadways to remove excess water from the freezing zone helps reduce the frost action potential.

This soil is in capability subclass IVe and woodland suitability subclass 2o.

ZnC2—Zanesville silt loam, 6 to 12 percent slopes, eroded. This moderately sloping soil is deep and well drained. This soil is on uplands. It is on ridgetops and upper parts of side slopes along natural drainageways. Individual areas of this unit are long and irregular in shape, generally following the ridgetops. They are dominantly about 30 to 40 acres in size.

In a typical profile of the uneroded part of the unit, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 47 inches thick. The upper part is yellowish brown, strong brown, and dark brown, firm and friable silt loam and silty clay loam, and the lower part is a very firm and brittle fragipan of dark brown and light yellowish brown silty clay loam. The underlying material, to a depth of 79 inches, is yellowish brown, very firm silty clay. Below this is light gray, soft clay shale.

This unit includes eroded and uneroded soils. About 60 percent of this unit is eroded and has a mixture in the plow layer of surface layer and subsoil.

Included with this soil in mapping are a few small areas of strongly sloping and well drained Gilpin soils along drainageways and a few areas of well drained Wellston soils are along the ridgetops. Small areas of alluvial soils are along the drainageways. These inclusions make up 5 to 15 percent of the unit.

This soil has moderate available water capacity and is slowly permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 2 to 3 feet during the months of December through April. A very firm and brittle fragipan, at a depth of 24 to 32 inches, restricts the downward movement of roots.

Most areas of this soil are used for growing corn, soybeans, and small grain. Many areas are used for hay and pasture, and some are woodland. This soil has fair potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to corn, soybeans, and small grain. Measures that control erosion and surface runoff are needed if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help control erosion and runoff. Because the very slowly permeable fragipan restricts water movement, this soil is often saturated in winter and spring. This causes delays in farming operations. This soil is somewhat droughty during long dry periods in the summer. The use of crop residue and cover crops also help to control erosion and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to deep rooted legumes, such as alfalfa, because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, poor tilth, and reduced density of plant growth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help keep the pasture and soil in good condition.

This soil is suited to trees. The rooting zone is limited mainly to the area above the fragipan and fair production can be expected.

This soil has moderate limitations for building sites without basements because of the slope and the seasonal high water table. Grading the soil to modify the slope, designing buildings to complement the slope, installing drains around foundations and constructing buildings without basements are ways to help overcome the limitations. This soil has severe limitations for septic tank absorption fields because of seasonal high water table and slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the seasonal high water table help overcome the limitation.

Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of the high potential for frost action. Drainage should be installed to lower the water table so that frost action can be reduced.

This soil is in capability subclass IIIe and woodland suitability subclass 3o.

ZnC3—Zanesville silt loam, 6 to 12 percent slopes, severely eroded. This moderately sloping soil is deep and well drained. This soil is on uplands. It is on ridgetops and upper side slopes along natural drainageways. Individual areas of this unit are long and irregular in shape, usually following the ridgetops. They are dominantly 10 to 20 acres in size.

In a typical profile, the surface layer is yellowish brown silt loam that contains dark yellowish brown material from the subsoil. It is about 5 inches thick. The subsoil is about 56 inches thick. The upper part is strong brown, firm silty clay loam; the middle part is a very firm and brittle fragipan of yellowish brown and light yellowish brown silty clay loam; and the lower part is brownish yellow loam. Stratified sandstone and shale bedrock is below a depth of about 61 inches. In many areas the surface layer is strong brown silty clay loam because the surface layer has been eroded away.

Included with this soil in mapping are a few areas of well drained Gilpin soils along drainageways and small areas of well drained Wellston soils along the ridgetops. Other inclusions are small areas of gullied soils and areas of less eroded Zanesville soils. Small areas of alluvial soils are along the drainageways. Also included are small areas of this Zanesville soil that has a thicker surface layer, mainly on the lower part of the slopes. These inclusions make up about 3 to 10 percent of the unit.

This soil has moderate available water capacity and is slowly permeable. Surface runoff is rapid. The surface layer has low organic matter content. It is often difficult to till because of the amount of subsoil mixed with it. Depth to a seasonal high water table ranges from 2 to 3 feet during the months of December through April. A very firm and brittle fragipan, at a depth of 24 to 42 inches, restricts the downward movement of roots.

Most of this soil is used for growing corn, soybeans, and small grain. Many areas are used for hay and pasture and some are woodland. This soil has fair potential for agricultural crops and poor potential for most engineering uses.

This soil is suited to small grain. Row crops can be grown occasionally. Measures that control erosion and surface water runoff are needed if cultivated crops are grown. Crop rotation, minimum tillage, diversions, contour farming, or grassed waterways help control erosion and soil loss from runoff. Because the very slowly permeable fragipan restricts water movement, this soil is often saturated in winter and spring, which causes delays in farming operations. This soil is somewhat droughty during long dry periods in the summer. The use of crop residue and cover crops also help control erosion and maintain tilth and organic matter content of this soil.

This soil is suited to grasses and shallow rooted legumes for hay and pasture. It is not suited to deep rooted legumes, such as alfalfa, because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. The rooting zone is limited mainly to the area above the fragipan and fair production can be expected.

This soil is moderately limited for building sites without basements because of slope and the seasonal high water table. Grading the soil to modify the slope, designing buildings to complement the slope, installing drains around foundations, and constructing buildings without basements are ways to help overcome the limitations. This soil has severe limitations for septic tank absorption fields because of seasonal high water table and slow permeability. Increasing the size of the absorption field and installing adequate drainage to lower the seasonal high water table help overcome the limitation. Central sewer systems are usually needed because the limitations for soils that have a fragipan are difficult to overcome. This soil has severe limitations for local roads and streets because of high potential for frost action. Drainage should be installed to lower the water table and to remove water from the freezing zone so that frost action can be reduced.

This soil is in capability subclass IVe and woodland suitability subclass 4d.

Use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture, and

woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Soil maps for detailed planning." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

The Indiana Soil and Water Conservation Needs Inventory, (*3*) published in 1968 by the Cooperative Extension Service of Purdue University, shows 165,489 acres in the county were used for crops and pasture in 1967. Of this total, 40,086 acres were used for permanent pasture; 52,134 acres for row crops, mainly corn and soybeans; 10,816 acres for close grown crops, mainly wheat; 31,167 acres for rotation hay and pasture and hayland; 13,629 acres for conservation use only; and the rest was idle cropland.

The potential of the soils in Dubois County for increased production of food is good. About 30,466 acres of potentially good cropland are currently used as woodland, and about 18,117 acres are used as pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Soil erosion is the major soil problem on about 70 percent of the cropland and pasture in Dubois County. If the slope is more than 2 percent, erosion is a hazard. Alford, Otwell, Parke, Pekin, Pike soils, for example, have slopes of 2 to 6 percent or more.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a layer in the subsoil that limits the depth of the root zone. Such layers include fragipans, as in the Dubois, Otwell, Pekin, Tilsit, and Zanesville soils, or bedrock, as in the Gilpin, Berks, and Wellston soils. Erosion also reduces productivity on soils that tend to be droughty, such as the Princeton soils. Second, soil erosion results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, preparing a good seedbed and tilling are difficult because the original, friable surface soil has been eroded away. Such spots are common in areas of severely eroded Wellston and Zanesville soils.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that do not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land and also provide nitrogen and improve tilth for the following crop. Controlled grazing, such as pasture rotation, proper stocking rates, and restricted use during wet periods, maintains a good cover of plants, which reduces runoff and erosion.

Slopes are so short and irregular that contour tillage or terracing is not practical in most areas of the sloping Negley and Otwell soils. On these soils, cropping systems that provide substantial vegetative cover are required to control erosion, unless minimum tillage is practiced. Minimizing tillage and leaving crop residues on the surface help to increase infiltration and to reduce hazards of runoff and erosion. These practices can be adapted to most soils in the survey area. No-tillage planting of corn, which is common on an increasing acreage, is effective in reducing erosion on sloping soils and can be adapted to most cropped soil in the survey area.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are most practical on deep, well drained soils that have regular slopes. Pike soils and Parke and Alford soils that have slopes of less than 12 percent are examples of soils which are suitable for terraces. Other soils are less suitable for terracing and diversions because of strong slopes; a fragipan in the subsoil, which would be exposed in terrace channels; or bedrock at a depth of less than 40 inches.

Contour farming and contour stripcropping help control erosion and are suited to the survey area. They are best adapted to soils that have uniform slopes, such as Tilsit, Wellston, and Zanesville soils.

Grassed waterways are used throughout the survey area to help control erosion. They are best adapted to deep, well drained soils, such as Wellston and Parke soils.

Soil blowing is a hazard on Princeton soils. Soil blowing can damage young crops in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on about 22 percent of the acreage used for crops and pasture in the survey area. Unless artificially drained, some soils are naturally so wet that the production of crops common to the area is generally not possible. These are the poorly drained and very poorly drained Bonnie, Montgomery, Peoga, and Petrolia soils of which about 11,220 acres are in the survey area.

Unless artificially drained, the somewhat poorly drained soils are so wet that crops are damaged during most years. In this category are the Bartle, Dubois, Johnsburg, McGary, and Stendal soils, which total about 34,453 acres.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and subsurface drainage is needed in most areas of the somewhat poorly drained, poorly drained, and very poorly drained soils used for intensive row cropping. Drains have to be more closely spaced in soils that have slow permeability than in the more permeable soils. Subsurface drainage is very slow in Bartle, Dubois, Johnsburg, McGary, and Montgomery soils. Finding adequate outlets for subsurface drainage systems is difficult in many areas of Bonnie soils.

Soil fertility is naturally low in most soils of the uplands and terraces in the survey area. All but McGary and Montgomery soils are naturally acid. Some of the soils on flood plains, such as Chagrin, Nolin, and Petrolia soils range from medium acid to mildly alkaline and are naturally higher in plant nutrients than most upland soils. Other soils on flood plains, such as Bonnie, Burnside, Cuba, Steff, and Stendal soils, are strongly or very strongly acid.

Many soils are naturally very strongly acid, and, if they have never been limed, they require applications of ground limestone to raise the pH level sufficiently for good growth of alfalfa and other crops that grow only on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Some of the soils used for crops in the survey area have a silt loam surface layer that is light in color and low in content of organic matter. Generally the structure of such soils is weak, and intense rainfall causes the formation of crust on the surface. The crust is hard when it is dry, and it is nearly impervious to water. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residues, manure, and other organic material can help to improve soil structure and to reduce crust formation.

Fall plowing is generally not a good practice on the county's light colored soils that have a silt loam surface layer, because a crust forms during the winter and spring. Also, about 70 percent of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in the fall.

The dark colored Montgomery soils are clayey. Tilth is a problem, because the soils often stay wet until late in spring. If they are wet when plowed, they tend to be very cloddy when dry and good seedbeds are difficult to prepare. Fall plowing generally results in good tilth in the spring.

Most of the soils in the survey area have a silt loam surface layer that is easily compacted. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Once the surface is compacted, it reduces infiltration and increases runoff. Timely deferment of grazing and restricted use during wet periods keep the soil in good condition.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Corn and soybeans are the common row crops. Grain sorghum, sugar beets, potatoes, and similar crops can be grown if economic conditions are favorable.

Wheat is the common close-growing crop. Oats, rye, barley, and buckwheat could be grown, and grass seed could be produced from fescue, redtop, and bluegrass.

Special crops are not grown extensively in the survey area. A small acreage in the county is used for strawberries. In addition, there are areas that can be adapted to other special crops, such as grapes and many vegetables. Apples and peaches can also be grown in the county.

Deep soils that have slopes of less than 6 percent and have good natural drainage are well suited to many vegetables and small fruits. In the survey area these are Alford, Parke, and Pike soils on slopes of less than 6 percent. They total about 5,199 acres. Also, if irrigated, about 202 acres of the Princeton soils that have slopes

of less than 6 percent are very well suited to vegetables and small fruits. Crops can generally be planted and harvested earlier on all these soils than on the other soils in the survey area.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Pasture plants commonly grown in the area are mixtures of fescue, timothy, alfalfa, and red clover. Other plants suited to the survey area are bluegrass, orchardgrass, reed canarygrass, ladino clover, and lespedeza. Alfalfa and other deep rooted legumes are not suited to soils that have a seasonal high water table, such as Stendal, Bonnie, or McGary soils, unless artificial drainage is adequate. Also, alfalfa is not suited to soils that have a fragipan, such as Dubois, Tilsit, Zanesville, or Otwell soils, because root growth is restricted by the fragipan.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system (*7*), soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use. (None in Dubois County.)

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production. (None in Dubois County.)

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Woodland management and productivity

Mitchell G. Hassler, forester, Soil Conservation Service, assisted in the preparation of this section.

The original cover in Dubois County was mostly hardwood trees. According to the Indiana Soil and Water Conservation Needs Inventory, published in 1968 by the Cooperative Extension Service of Purdue University, 88,695 acres of woodland are in the county.

The soils of the survey area vary widely in their suitability for wood crops. The major characteristics of soils that affect the productivity for trees are the ability to maintain an optimum moisture content and to permit the development of an adequate root system. Other characteristics that affect the growth of timber crops are thickness of the surface layer, natural supply of plant nutrients, texture and consistence of the soil material, aeration, and depth to the water table.

For management purposes, the trees in Dubois County can be separated into five major types. The types are named for the dominant tree species, but they may vary widely in mixture of trees growing with the major species.

Upland oak.—This type of timber is dominant in the county. Upland oak is on a large percentage of the moderately well drained and well drained soils on uplands. It is mainly a mixture of white, black, red, scarlet, and chinquapin oaks. Included with the oaks are hickory, ash, sugar maple, and tulip-poplar.

Tulip-poplar.—This type of timber is generally on the lower parts of the north- and northeast-facing slopes (the cooler aspects) and in narrow valleys or coves. Tulip-poplar is presently one of the more valuable trees, and the species is generally encouraged in management. Other species commonly growing with tulip-poplar are white oak, red oak, hickory, beech, ash, black walnut, and sugar maple.

Pin oak.—This type of timber grows only on somewhat poorly drained to very poorly drained soils of the county. Associated species are red maple, sweetgum, swamp white oak, ash, and hickory.

Sweetgum.—Sweetgum grows on sites similar to those described for pin oak and generally is the dominant species on abandoned fields. Associated species are red maple, river birch, ash, hickory, and sycamore.

Pine.—Naturally seeded stands of pine are nonexistent in Dubois County. Planted pine stands have been established in the past and will be used in the future on sites not suitable for hardwoods. Species of pine used are Virginia, white, shortleaf, and red.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal

winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blow down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Recreation

The importance of outdoor recreation planning is substantiated by the following statement of the Outdoor Recreation Resources Review Commission: "Outdoor recreation activity, already a major part of American life, will triple by the year 2000. Outdoor recreation should be an integral element in local land-use planning (*4*)."

The landscape and natural resources of Dubois County, as well as the location of the county in relation to centers of population, make it feasible to develop some recreational enterprises that can produce income. Among the most likely enterprises are hunting areas, shooting preserves, improved picnic areas, camping areas, golf courses, and areas for fishing and other aquatic sports.

The Ferdinand State Forest and community conservation clubs (fig. 9) are examples of recreational facilities that already have been developed. The construction of Patoka Dam and Reservoir and the development of watersheds provide opportunity for boating, fishing, swimming, and other water-based recreation. Some well-drained soils in upland areas are well suited to picnic grounds, intensive recreation, and tent and camp trailer sites.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensi-

Figure 9.—Planting pine along lake stabilizes this soil, Wellston silt loam, 6 to 12 percent slopes, eroded. This stabilization reduces erosion of the soil, which decreases sedimentation in the lake.

ty of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, sorghum, soybeans, sunflowers, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are

fescue, timothy, orchardgrass, lespedeza, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, lambsquarter, pokeweed, ragweed, and wheatgrass.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, persimmon, sassafras, sumac, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, arrowhead, buttonbush, willow, duckweed, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, killdeer, woodchuck, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5)

plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding or ponding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils that are suitable for the establishment and maintenance of turf for lawns and ornamental trees and shrubs for landscaping. The best soils are firm after rains, are not dusty when dry, and absorb water readily and hold sufficient moisture for plant growth. The surface layer should be free of stones. If shaping is required, the soils should be thick enough over bedrock or hardpan to allow for necessary grading. In rating the soils, the availability of water for sprinkling is assumed.

Sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the

soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of

each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 14 gives information on the soil properties and site features that affect water management. The kind of soil limitations, if any, are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable com-

paction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering properties and classification

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and

maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil.

Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*8*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning flood plain, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, acid, mesic Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil series and morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*6*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*8*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Alford series

The Alford series consists of deep soils that are well drained and moderately permeable. These soils are on loess-covered uplands. They formed in loess. Slopes range from 2 to 25 percent. This soil is more acid in the C horizon than is described as the range for the series. This difference does not alter the usefulness or behavior of the soil.

Alford soils are similar to Pike soils and are commonly adjacent to Princeton soils. Pike soils are more acid and are over stratified, sandy lakebed sediments. Sediments begin at a depth of about 60 inches. Princeton soils which contain more sand in the solum, are on slopes above and adjacent to the Alford soils.

A typical pedon of Alford silt loam, 2 to 6 percent slopes, in a cultivated field, 2,640 feet east and 640 feet south of the northwest corner of sec. 27, T. 1 N., R. 6 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A2—7 to 13 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure parting to moderate medium granular; friable; common fine roots; continuous thin pale brown (10YR 6/3) silt coatings on faces of peds; medium acid; clear wavy boundary.

B21t—13 to 27 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; continuous thin brown (7.5YR 5/4) clay films in pores and on faces of peds; strongly acid; gradual wavy boundary.

B22t—27 to 34 inches; strong brown (7.5YR 5/6) silt loam; weak medium and fine subangular blocky structure; firm; few fine roots; continuous thin brown (7.5YR 5/4) clay films in pores and on faces of peds; very strongly acid; gradual wavy boundary.

B31t—34 to 44 inches; strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; continuous thin brown (7.5YR 4/4) clay films in root channels and as linings in voids; very strongly acid; gradual wavy boundary.

B32t—44 to 55 inches; brown (7.5YR 5/4) silt loam; weak medium subangular blocky structure; friable; continuous thin brown (7.5YR 4/4) clay films in root channels and as linings in voids; few discontinuous distinct thin pale brown (10YR 6/3) silt coatings on faces of peds; very strongly acid.

C—55 to 60 inches; brown (7.5YR 5/4) silt loam; massive; friable; few pale brown (10YR 6/3) silt fillings in old root channels; strongly acid.

The solum ranges from 40 to 60 inches in thickness. Loess ranges from 4 to 10 feet in depth.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. Reaction ranges from medium acid to very strongly acid.

The C horizon is silt loam or silt. In some pedons, it is faintly mottled.

Bartle series

The Bartle series consists of deep soils that are somewhat poorly drained and very slowly permeable. These soils are on stream terraces. They formed in silty alluvium. Slopes range from 0 to 2 percent.

Bartle soils are similar to Dubois soils and are commonly adjacent to Pekin and Stendal soils. Dubois soils have a more strongly expressed fragipan that is higher in clay content. Pekin soils do not have gray mottles in the upper part of the B horizon and are near the terrace

breaks. Stendal soils do not have the fragipan or argillic horizon and are on the lower flood plains.

Typical pedon of Bartle silt loam, in a cultivated field, 1,800 feet east and 260 feet south of the northwest corner of sec. 17, T. 2 S., R. 4 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; few fine pockets of yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) silt loam; weak medium granular structure; friable; many fine and medium roots; few fine black (10YR 2/1) soft iron and manganese oxide accumulations; slightly acid, abrupt smooth boundary.

A2—10 to 17 inches; pale brown (10YR 6/3) silt loam; common medium distinct light gray (10YR 7/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine and medium roots; few fine black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

A&B—17 to 22 inches; light brownish gray (10YR 6/2) silt loam; weak coarse subangular blocky structure (A part); yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) silty clay loam; weak coarse prismatic structure parting to moderate medium subangular blocky (B part); firm; few fine roots; discontinuous thin grayish brown (10YR 5/2) clay films on faces of peds and in voids; few fine and medium black (10YR 2/1) and dark reddish brown (2.5YR 3/4) iron and manganese oxide accumulations; very strongly acid; gradual irregular boundary.

B2t—22 to 30 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; few fine roots; continuous thick grayish brown (10YR 5/2) and gray (10YR 6/1) silt and clay films on faces of peds and in voids; very strongly acid; gradual irregular boundary.

Bx1—30 to 40 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; strong coarse prismatic structure parting to strong medium subangular blocky; very firm and brittle; continuous thick light brownish gray (10YR 6/2) silt coatings on faces of peds; common fine distinct strong brown (7.5YR 5/6) iron and manganese oxide accumulations; very strongly acid; gradual wavy boundary.

Bx2—40 to 50 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; strong very coarse prismatic structure parting to weak medium subangular blocky; very firm and brittle; continuous thick light brownish gray (10YR 6/2) silt coatings on prism faces; very strongly acid; clear wavy boundary.

C—50 to 60 inches; light brownish gray (10YR 6/2), light gray (10YR 7/1), and yellowish brown (10YR 5/6) stratified silt loam, silty clay loam, and fine sand; massive; friable; strongly acid.

The solum ranges from 48 to 60 inches in thickness. The fragipan is at a depth of 24 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4 with mottling. It is silt loam or silty clay loam.

The Bx horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2 with mottles of higher chroma.

Berks series

The Berks series consists of moderately deep soils that are well drained and moderately permeable. These soils are on uplands. They formed in material weathered from sandstone, siltstone, and shale. Slopes range from 20 to 50 percent.

Berks soils are similar to Gilpin soils and are commonly adjacent to Zanesville soils. Gilpin soils are on the same or adjacent side slopes. They have an argillic horizon and less coarse fragments in the solum. Zanesville soils are on the adjacent ridgetops. They are over 40 inches deep to bedrock and have a very firm and brittle fragipan in the subsoil.

A typical pedon of Berks channery silt loam in an area of Gilpin-Berks complex, 20 to 50 percent slopes, in woods, 790 feet west and 1,150 feet north of the center of sec. 23, T. 1 N., R. 3 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) channery silt loam; moderate fine and medium granular structure; friable; many fine and medium roots; 25 percent sandstone fragments that are less than 1 inch in length; medium acid; abrupt wavy boundary.

A2—3 to 8 inches; yellowish brown (10YR 5/4) channery silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; many fine and medium roots; 30 percent sandstone fragments that are 1 inch to 2 inches in length; very strongly acid; clear wavy boundary.

B21—8 to 19 inches; yellowish brown (10YR 5/4) channery silt loam; moderate medium subangular blocky structure; friable; common fine and medium roots; 36 percent sandstone fragments that are 3 to 10 inches in length; very strongly acid; clear wavy boundary.

B22—19 to 29 inches; yellowish brown (10YR 5/6) channery silt loam; moderate medium subangular blocky structure; friable; few fine roots; 40 percent sandstone fragments that are 4 to 10 inches in length; very strongly acid; clear wavy boundary.

R—29 inches; rippable sandstone bedrock.

The solum ranges from 18 to 36 inches in thickness. Bedrock is at a depth of 20 to 40 inches and is stratified paralithic or lithic.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It is channery silt loam. In a few pedons, the texture of the surface layer is loam.

The B2 horizon has hue of 10YR, value or 5, and chroma of 4 to 6. It is channery silt loam or channery loam. The amount of fragments ranges from 35 to 70 percent.

Bonnie series

The Bonnie series consists of deep soils that are poorly drained and slowly permeable. These soils are on flood plains. They formed in acid, silty alluvium. Slope ranges from 0 to 2 percent.

Bonnie soils are similar to Stendal soils. Stendal soils are less gray in the control section.

Typical pedon of Bonnie silt loam, in a cultivated field, 2,440 feet north and 10 feet west of the southeast corner of sec. 10, T. 1 S., R. 3 W.

Ap—0 to 12 inches; grayish brown (10YR 5/2) silt loam; many fine and medium faint light brownish gray (10YR 6/2) and many medium distinct brown (10YR 4/3) mottles; moderate medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

C1g—12 to 32 inches; light gray (10YR 7/1) silt loam; common medium faint light gray (10YR 7/2) and few fine distinct brownish yellow (10YR 6/6) mottles; weak medium granular structure; friable; few fine roots in the upper half of the horizon; very strongly acid; clear wavy boundary.

C2g—32 to 60 inches; light gray (10YR 7/1) silt loam; many fine and medium distinct light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) mottles; massive; friable; common fine black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid.

The Ap horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or less.

The C horizon has hue of 10YR, 2.5Y, or 5Y; color value of 5 to 7; and chroma of 2 or less. Mottles are of higher chroma. It commonly is silt loam but contains strata of silty clay loam, loam, sandy loam, or loamy fine sand in the lower part of some pedons. It is strongly acid or very strongly acid.

Burnside series

The Burnside series consists of deep soils that are well drained and moderately permeable. These soils are on flood plains. They formed in silty and loamy, channery alluvium over sandstone, siltstone, and shale. Slopes range from 0 to 2 percent.

Burnside soils are commonly adjacent to Cuba and Steff soils in the landscape. Cuba and Steff soils have more clay but less than 15 percent sand that is coarser than very fine sand throughout the control section. Mottles in the Steff soils have chroma of 2 and are within a depth of 24 inches of the surface.

A typical pedon of Burnside silt loam in woods, 2,300 feet north and 1,720 feet west of the southeast corner of sec. 13, T. 1 N., R. 3 W.

A11—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; common fine roots; 5 percent sandstone fragments; slightly acid; clear wavy boundary.

A12—4 to 12 inches; brown (10YR 4/3) silt loam; weak medium granular structure; friable; few fine roots; 10 percent sandstone fragments that are 1/2 inch to 2 inches in size; strongly acid; clear wavy boundary.

C1—12 to 21 inches; brown (10YR 4/3) channery loam; massive; friable; 40 percent sandstone fragments that are 1 inch to 4 inches in size; very strongly acid; clear wavy boundary.

C2—21 to 46 inches; brown (10YR 4/3) very channery loam; massive; friable; 80 percent sandstone fragments that are 1 inch to 6 inches in size; very strongly acid; abrupt wavy boundary.

IICr—46 inches; light gray (10YR 7/2) and light olive gray (5Y 6/2) soft shale and light brown (7.5YR 6/4) sandstone.

Bedrock is at a depth of 40 to 65 inches.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Some pedons in uncultivated areas have a color value of 3.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is silt loam, loam, channery silt loam, or channery loam in the upper part and channery or very channery loam or silt loam in the lower part. Material coarser than sand ranges from 50 to 80 percent in the lower part of the horizon. It is strongly acid or very strongly acid.

Chagrin series

The Chagrin series consists of deep soils that are well drained and moderately permeable. These soils are on flood plains. They formed in loamy alluvium. Slopes range from 0 to 2 percent.

Chagrin soils are adjacent to Cuba soils and Nolin soils in the landscape. Cuba soils are strongly acid or very strongly acid. Cuba and Nolin soils are fine silty in the control section. Nolin soils are on adjacent, slightly lower positions of the flood plain.

A typical pedon of Chagrin silt loam, in a cultivated field, 1,120 feet north and 1,660 feet west of the southeast corner of sec. 20, T. 1 N., R. 4 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam; pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B2—10 to 32 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common fine roots; continuous thin dark brown (10YR 4/3) silt coatings on faces of peds; many dark brown (10YR 4/3) worm casts in channels; neutral; clear wavy boundary.

C1—32 to 38 inches; yellowish brown (10YR 5/4) loam; massive; friable; common fine roots; discontinuous thin dark brown (10YR 4/3) silt coatings on faces of peds; common dark brown (10YR 4/3) worm casts in channels; neutral; clear wavy boundary.

C2—38 to 60 inches; yellowish brown (10YR 5/6) fine sandy loam; massive; friable; few fine roots; few dark brown (10YR 4/3) worm casts in channels; neutral.

The control section is slightly acid or neutral.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It is generally silt loam, but some pedons have a silt loam or sandy loam surface layer.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 5. It is silt loam, loam, or sandy loam.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam, loam, or sandy loam and is commonly stratified.

Cuba series

The Cuba series consists of deep soils that are well drained and moderately permeable. These soils are on flood plains. They formed in silty, acid alluvium. Slopes range from 0 to 2 percent.

Cuba soils are commonly adjacent to Steff and Stendal soils. Mottles in the Steff soils have chroma of 2 and are within a depth of 24 inches of the surface. Steff soils are in areas near the base of the uplands. Mottles in Stendal soils have chroma of 2 and are immediately below the Ap horizon. Steff soils are more nearly level or in slightly depressional areas.

Typical pedon of Cuba silt loam in a cultivated field, 1,710 feet north and 210 feet east of the center of sec. 28, T. 1 N., R. 3 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21—10 to 21 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure parting to moderate medium granular; friable; few fine roots; discontinuous thin brown (10YR 4/3) organic coatings on faces of some peds; very strongly acid; gradual wavy boundary.

B22—21 to 47 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; very strongly acid; clear wavy boundary.

C—47 to 60 inches; brown (10YR 5/3) silt loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; massive; friable; few fine distinct black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

The control section is strongly acid or very strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6.

The C horizon is commonly stratified. It is silt loam, loam, or fine sandy loam.

Dubois series

The Dubois series consists of deep soils that are somewhat poorly drained and very slowly permeable. These soils are on loess-capped lake plains. They formed in loess and the underlying, stratified sediments of lakebeds. Slopes range from 0 to 6 percent.

Dubois soils are similar to Bartle soils and are commonly adjacent to Otwell and Peoga soils. Bartle soils have a more weakly expressed fragipan and have more sand in the lower part of the solum. Otwell soils do not have the mottles that have chroma of 2 or less in the upper 10 inches of the argillic horizon. Peoga soils do not have a fragipan but do have a matrix color with chroma of 2 or less throughout the solum. Otwell soils are at higher positions and are around drainageways adjacent to the Dubois soils. Peoga soils are on broad flats and in depressions between the drainageways.

A typical pedon of Dubois silt loam, 0 to 2 percent slopes, in a cultivated field, 240 feet west and 1,100 feet north of the southeast corner of sec. 13, T. 1 S., R. 6 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam; moderate medium and fine granular structure; friable; few fine roots; few fine black (10YR 2/1) iron and manganese oxide accumulations; slightly acid; abrupt smooth boundary.

A2—10 to 16 inches; light yellowish brown (10YR 6/4) silt loam; common medium faint light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; common fine black (10YR 2/1) iron and manganese oxide accumulations; medium acid; clear wavy boundary.

B2t—16 to 30 inches; light brownish gray (10YR 6/2) silty clay loam; many medium and coarse distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; firm; few fine roots; light gray (10YR 7/1) and light brownish gray (10YR 6/2) thin discontinuous films and light brownish gray (10YR 6/2) thick continuous clay films on faces of peds; common black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid; gradual irregular boundary.

Bx1—30 to 39 inches; light brownish gray (10YR 6/2) silty clay loam; many medium and coarse distinct yellowish brown (10YR 5/6) mottles; strong very coarse prismatic structure parting to weak thick platy; very firm and brittle; thin discontinuous yellowish brown (10YR 5/4) and thick light gray (10YR 7/1) silt films and thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds and in voids; very strongly acid; clear wavy boundary.

IIBx2—39 to 58 inches; dark yellowish brown (10YR 4/4) loam; strong very coarse prismatic structure; very firm and brittle; thick discontinuous light brownish gray (10YR 6/2) silt films and thin patchy light brownish gray (10YR 6/2) clay films on faces of peds and in voids; common black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid; diffuse wavy boundary.

IIB31—58 to 70 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate very coarse prismatic structure; friable; thin to thick continuous yellowish brown (10YR 5/4) silt films on faces of peds; common black (10YR 2/1) iron and manganese oxide accumulations; slightly acid; clear wavy boundary.

IIB32—70 to 80 inches; strong brown (7.5YR 5/6) stratified sandy clay loam, sandy loam, and loamy sand; common coarse distinct brown (7.5YR 5/2) and few fine distinct brown (10YR 5/3) mottles; massive; friable; slightly acid.

The solum typically is 52 to 90 inches thick. The fragipan is at a depth of 20 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is silt loam or silty clay loam. It has medium or coarse subangular blocky structure.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6. It is commonly silt loam or silty clay loam. In some pedons individual horizons are loam, sandy loam, or clay loam. The B horizon has strong or very strong, very coarse prismatic structure.

The B3 horizon is stratified sandy loam, sandy clay loam, loamy sand, silt loam, and silty clay loam.

Gilpin series

The Gilpin series consists of moderately deep soils that are well drained and moderately permeable. These soils are on uplands. They formed in material weathered from sandstone, shale, and siltstone. Slopes range from 12 to 50 percent.

Gilpin soils are similar to Wellston soils and are commonly adjacent to Berks and Zanesville soils. Wellston soils have a thicker solum and are deeper to skeletal material and to bedrock. They are on ridgetops and side slopes above the Gilpin soils. Berks soils do not have an argillic horizon. They are on steep slopes below and mixed with the Gilpin soils. Zanesville soils are deeper to bedrock and have a very firm and brittle fragipan in the subsoil. They are on moderately sloping ridgetops and side slopes.

A typical pedon of Gilpin silt loam, 18 to 25 percent slopes, in woods, 2,220 feet north and 1,450 feet west of the southeast corner of sec. 16, T. 3 S., R. 3 W.

Ap—0 to 6 inches; brown (10YR 4/3) silt loam; moderate fine and medium granular structure; friable; common fine roots; 2 percent sandstone fragments that are 1/2 to 3/4 inch in length; strongly acid; clear wavy boundary.

B21—6 to 15 inches; yellowish brown (10YR 5/6) channery silt loam; weak medium subangular blocky structure; friable; few fine roots; patchy thin pale brown (10YR 6/3) silt coatings on faces of some peds; 20 percent sandstone fragments that are 1 to 2 1/2 inches in length; strongly acid, clear wavy boundary.

B22t—15 to 21 inches; strong brown (7.5YR 5/6) channery clay loam; weak medium subangular blocky structure; firm; discontinuous thin brown (7.5YR 5/4) clay films on faces of some peds; 30 percent sandstone fragments that are 1 inch to 4 1/2 inches in length; strongly acid; clear wavy boundary.

B3—21 to 28 inches; yellowish brown (10YR 5/6) channery loam; massive; friable; 35 percent sandstone fragments that are 2 to 6 inches in length; very strongly acid; clear wavy boundary.

Cr—28 inches; rippable sandstone and shale.

The solum ranges from 20 to 36 inches in thickness. Bedrock is at a depth of 20 to 40 inches. It is stratified paralithic or lithic. Individual horizons of the solum are 5 to 35 percent coarse fragments of sandstone, shale, or siltstone, and the C horizon is 30 to 90 percent coarse fragments. Reaction is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is mainly silt loam but is loam in some pedons.

The B horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. It is silt loam, silty clay loam, clay loam, or their channery analogues.

The C horizon is typically channery loam or sandy loam and is underlain by sandstone, shale, or siltstone.

Johnsburg series

The Johnsburg series consists of deep soils that are somewhat poorly drained and very slowly permeable. These soils are on loess-capped uplands. They formed in loess and the underlying residuum of sandstone, shale, and siltstone. Slopes range from 0 to 2 percent.

Johnsburg soils are similar to the Tilsit soils and are commonly adjacent to the Zanesville soils in the landscape. Tilsit soils do not have gray mottles within the upper 10 inches of the argillic horizon or within 16 inches of the surface. Zanesville soils have greater than 35 percent base saturation and are better drained. They are moderately sloping and on side slopes near the ridgetops.

Typical pedon of Johnsburg silt loam, 0 to 2 percent slopes in a cultivated field, 200 feet west and 620 feet south of the northeast corner of sec. 12, T. 1 S., R. 3 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, moderate medium granular structure; friable; common black (10YR 2/1) iron and manganese oxide accumulations; many fine roots; slightly acid; abrupt smooth boundary.

B1—8 to 11 inches; light yellowish brown (10YR 6/4) silt loam; weak medium and fine subangular blocky structure; friable; common fine tubular and vesicular pores; very strongly acid; clear wavy boundary.

B21t—11 to 18 inches; brownish yellow (10YR 6/6) silt loam; moderate to weak medium subangular blocky structure; firm; common fine roots; common fine tubular and vesicular pores; few discontinuous yellowish brown (10YR 5/6) clay films on faces of peds; very pale brown (10YR 7/4) silt coatings on faces of some peds; common fine black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

B22t—18 to 22 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct strong brown (7.5YR 5/8) and yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure parting to moderate medium and coarse angular blocky; firm; light gray (10YR 7/2) thin continuous silt coatings on faces of peds; common fine roots; fine common tubular and vesicular pores; common discontinuous distinct thin brown (10YR 5/3) clay films on faces of peds; fine black (10YR 2/1) iron manganese oxide accumulations; extremely acid; clear irregular boundary.

Bx1—22 to 32 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/8) mottles; strong very coarse prismatic structure parting to moderate coarse angular blocky; very firm and brittle; few fine roots on faces of peds; common fine tubular and vesicular pores; thin to thick continuous light gray (10YR 7/2) silt coatings and silty clay loam seams on faces of peds; thin discontinuous brown (10YR 5/3) clay films on faces of peds and as accumulations; extremely acid; clear wavy boundary.

Bx2—32 to 39 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct strong brown (7.5YR 5/8) and light brownish gray (10YR 6/2) mottles; strong very coarse prismatic structure; very firm and very brittle; few fine roots on faces of peds; common fine tubular and vesicular inped pores; thin continuous light gray (10YR 7/2) silt coatings and silty clay loam seams on prismatic faces; common discontinuous faint brown (10YR 5/3) clay films on faces of peds and as linings of voids; extremely acid; gradual wavy boundary.

IIBx3—39 to 54 inches; yellowish brown (10YR 5/6) silty clay loam; very strong very coarse prismatic structure; very firm and very brittle; very few roots on faces of peds; fine common tubular and vesicular inped pores; thin continuous gray (10YR 6/1) silt coatings and silty clay loam seams on faces of peds and along old voids (white when dry); pinkish gray (7.5YR 6/2) thin discontinuous clay films on faces of peds and as linings of voids; 3 percent coarse fragments; extremely acid; diffuse wavy boundary.

IIBx4—54 to 62 inches; yellowish brown (10YR 5/6) silt loam; very strong very coarse prismatic structure; very firm and very brittle; common fine tubular and vesicular inped pores; thin discontinuous gray (10YR 6/1) clay films on faces of peds and as linings in some voids; thin continuous light gray (10YR 7/1) silt coatings on faces of peds and along some old voids; few black (10YR 2/1) iron and manganese oxide accumulations; 10 percent sandstone and shale fragments; very strongly acid; abrupt wavy boundary.

IIR—62 inches; fine grained sandstone.

The solum ranges from 50 to 80 inches in thickness. The fragipan is at a depth of 20 to 36 inches. Bedrock is at a depth of 48 to 72 inches and is paralithic or lithic.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. It is silt loam or silty clay loam.

The Bx and IIBx horizons have hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 6. It is silt loam or silty clay loam. In some areas, the IIBx is a loam.

McGary series

The McGary series consists of deep soils that are somewhat poorly drained and slowly or very slowly permeable. These soils are on lacustrine terraces. They formed in stratified, lacustrine deposits. Slopes range from 0 to 2 percent.

McGary soils are adjacent to Montgomery soils. The very poorly drained Montgomery soils have a mollic epipedon and are in slight depressions in the landscape.

Typical pedon of McGary silt loam, 0 to 2 percent slopes, in a cultivated field, 400 feet north and 1,050 feet east of the center of sec. 34, T. 1 N., R. 5 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

B21t—10 to 15 inches; light olive brown (2.5Y 5/4) silty clay; moderate fine angular blocky structure; firm; few fine roots; many continuous prominent medium and thick grayish brown (10YR 5/2) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—15 to 24 inches; light olive brown (2.5Y 5/4) silty clay; moderate fine angular blocky structure; firm; continuous medium grayish brown (2.5Y 5/2) clay films on faces of peds; neutral; clear wavy boundary.

B3—24 to 30 inches; light olive brown (2.5Y 5/4) silty clay; many medium distinct grayish brown (2.5Y 5/2) mottles; moderate fine and medium angular blocky structure; firm; slight effervescence; mildy alkaline; clear wavy boundary.

C—30 to 60 inches; light brownish gray (10YR 6/2) stratified silty clay loam and silty clay, thin layers of silt loam; many medium and coarse prominent yellowish brown (10YR 5/6) mottles; massive; very firm; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is silty clay loam or silty clay.

Montgomery series

The Montgomery series consists of deep soils that are very poorly drained and slowly or very slowly permeable. These soils are on lacustrine terraces. They formed in stratified, moderately fine and fine lacustrine deposits. Slopes range from 0 to 2 percent.

Montgomery soils are adjacent to McGary soils. The somewhat poorly drained McGary soils are not mollic and are at slightly higher positions in the landscape.

Typical pedon of Montgomery silty clay loam, in a cultivated field, 275 feet south and 1,320 feet west of the northeast corner of sec. 34, T. 1 N., R. 5 W.

Ap1—0 to 4 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; common fine and medium roots; slightly acid; abrupt clear boundary.

Ap2—4 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; massive; very firm; common fine and medium roots; neutral; abrupt clear boundary.

A13—12 to 22 inches; very dark gray (10YR 3/1) silty clay, very dark grayish brown (10YR 3/2) rubbed; common medium distinct olive brown (2.5Y 4/4) mottles; strong medium and coarse granular structure; firm, discontinuous thin very dark gray (10YR 3/1) clay films on faces of peds; few fine roots; neutral; clear wavy boundary.

B21—22 to 33 inches; dark gray (10YR 4/1) silty clay; many medium distinct light olive brown (2.5Y 5/4) mottles; strong fine and medium angular blocky structure; very firm; many continuous prominent thin and medium dark gray (10YR 4/1) clay films on faces of peds; few fine roots; neutral; clear wavy boundary.

B22—33 to 46 inches; dark grayish brown (10YR 4/2) silty clay; many medium distinct light olive brown (2.5Y 5/6) mottles; strong fine and medium angular blocky structure; very firm; continuous medium dark grayish brown (10YR 4/2) clay films on faces of peds; few fine roots; neutral; clear wavy boundary.

C—46 to 60 inches; gray (10YR 6/1) clay; many medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; calcareous; mildly alkaline.

The solum ranges from 30 to 48 inches in thickness.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The B2 horizon has hue of 10YR or 2.5YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silty clay.

The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6; and chroma of 2 or less. It is clay, silty clay, or silty clay loam and is stratified.

Negley series

The Negley series consists of deep soils that are well drained and moderately permeable and moderately rapidly permeable. These soils are on outwash terraces. They formed in loess and in loamy outwash materials. Slopes range from 6 to 50 percent.

Negley soils are commonly adjacent to Parke and Otwell soils. The fine silty Parke soils formed in 20 to 40 inches of loess over sandy outwash materials. Otwell

soils have a very firm and brittle fragipan in the subsoil. They are on the same or less sloping parts of the landscape and on ridgetops in the adjoining Illinoian lake plain.

A typical pedon of Negley loam, 18 to 50 percent slopes, in woods, 1,520 feet north and 230 feet west of the southeast corner of sec. 29, T. 1 S., R. 5 W.

A1—0 to 5 inches; brown (10YR 4/3) loam; moderate medium granular structure; friable; many fine and medium roots; common discontinuous faint thin dark yellowish brown (10YR 3/4) organic coatings on faces of peds; medium acid; clear smooth boundary.

A2—5 to 11 inches; yellowish brown (10YR 5/4) loam; weak thick platy structure; friable; many fine roots; medium acid; clear wavy boundary.

B21t—11 to 18 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; many fine roots; discontinuous thin dark brown (7.5YR 4/4) clay films on faces of peds; discontinuous thin brown (7.5YR 5/4) silt coatings on faces of some peds; strongly acid; clear wavy boundary.

B22t—18 to 40 inches; yellowish red (5YR 4/6) sandy clay loam; moderate medium and coarse angular and subangular blocky structure; firm; discontinuous thin red (2.5YR 4/6) clay films and common black (N 2/0) organic coatings on faces of peds; strongly acid; clear wavy boundary.

B23t—40 to 72 inches; yellowish red (5YR 4/6) sandy clay loam; weak medium and fine subangular blocky structure; firm; discontinuous thin red (2.5YR 4/6) clay films and few black (N 2/0) organic coatings of voids and on faces of peds; strongly acid; clear wavy boundary.

B3—72 to 80 inches; yellowish red (5YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; very strongly acid.

The solum ranges from 80 to 120 inches in thickness. Loess ranges from 0 to 20 inches in thickness. Reaction is strongly acid or very strongly acid.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is loam or silt loam.

The B2 horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 8. It is loam, clay loam, sandy loam, or sandy clay loam. In a few pedons, the upper part of the B horizon is silty clay loam.

Nolin series

The Nolin series consists of deep soils that are well drained and moderately permeable. These soils are on flood plains. They formed in alluvium. Slopes range from 0 to 2 percent.

Nolin soils are similar to Cuba soils and commonly adjacent to Chagrin soils in the landscape. Cuba soils have an acid solum. Chagrin soils have more sand in the control section and are on slightly higher parts of the landscape.

Typical pedon of Nolin silt loam, 330 feet north and 400 feet west of the southeast corner of sec. 24, T. 1 N., R. 5 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; neutral abrupt smooth boundary.

B21—10 to 13 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; discontinuous thin brown (10YR 4/3) silt coating on faces of peds; neutral; clear wavy boundary.

B22—13 to 41 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; discontinuous thin dark yellowish brown (10YR 4/4) silt coatings on faces of peds; neutral; clear wavy boundary.

C—41 to 60 inches; brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to weak medium granular; friable; slightly acid; clear wavy boundary.

The control section is neutral or slightly acid.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It commonly is silt loam, but has strata of fine sandy loam or sandy loam.

Otwell series

The Otwell series consists of deep soils that are well drained and moderately well drained and very slowly permeable. These soils are on loess-capped lake plains. They formed in loess and in the underlying, stratified lakebed sediments. Slopes range from 0 to 12 percent.

Otwell soils are similar to Zanesville soils and adjacent to Dubois soils. In the Zanesville soils the lower part of the solum formed in material weathered from residuum of sandstone, siltstone, and shale. In the Dubois soils, mottles in the upper part of the B horizon have chroma of 2. The Dubois soils are more nearly level and on the broad flats between drainageways.

A typical pedon of Otwell silt loam, 2 to 6 percent slopes, in a cultivated field, 1,540 feet south and 640 feet west of the northeast corner of sec. 22, T. 1 S., R. 6 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; common fine distinct strong brown (7.5YR 5/6) pockets of silty clay loam; moderate fine and medium granular

structure; friable; common fine roots; neutral; abrupt smooth boundary.

B21t—9 to 19 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; firm; few fine roots; patchy thin brown (7.5YR 5/4) clay and silt films on faces of peds; strongly acid; clear wavy boundary.

B22t—19 to 23 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular structure; firm; few fine roots; discontinuous thin brown (7.5YR 5/4) clay films and common light gray (10YR 7/2) silt films on faces of peds; dark brown (7.5YR 4/4) iron and manganese oxide accumulations; few very dark grayish brown (10YR 3/2) organic stains on faces of peds; very strongly acid; gradual wavy boundary.

Bx—23 to 44 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct yellowish brown (10YR 5/8) and pale brown (10YR 6/3) mottles; strong very coarse prismatic structure parting to thick platy; very firm and brittle; common fine vesicular pores; few flat roots on prism faces; continuous thin dark brown (7.5YR 4/4) clay films on ped faces and as linings of voids; continuous light brownish gray (10YR 6/2) silt coatings on faces of peds and as fillings between peds; few black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

IIB3—44 to 80 inches; strong brown (7.5YR 5/8) stratified loam, silt loam, and silty clay loam; common medium distinct pinkish gray (7.5YR 7/2) mottles; weak coarse subangular blocky structure; friable and firm; few dark brown (7.5YR 3/2) stains; strongly acid.

The solum generally ranges from 40 inches to about 80 inches in thickness. A fragipan is at a depth of 22 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. Some pedons have chroma of 8. It is silt loam or silty clay loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 2 to 6. In some pedons the chroma is 8. It is silt loam, silty clay loam, or, where a IIBx is present, loam. It is strongly acid or very strongly acid.

The IIB3 horizon is stratified loam, silt loam, sandy loam, and sandy clay loam.

Parke series

The Parke series consists of deep soils that are well drained and moderately permeable. These soils are on loess-capped lake plains. They formed in loess and in the underlying glacial drift. Slopes range from 2 to 18 percent.

Parke soils are similar to Pike soils and are adjacent to Negley soils. Pike soils have less sand in the control section and developed in loess that is more than 40 inches deep. Negley soils formed in loamy material that has a loess cap less than 20 inches deep and are steeper than the Parke soils.

A typical pedon of Parke silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 570 feet north and 630 feet east of the center of sec. 30, T. 1 S., R. 5 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; few fine distinct yellowish brown (10YR 5/6) pockets of silty clay loam material from the subsoil; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—9 to 30 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; continuous thin dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

IIB22t—30 to 36 inches; brown (7.5YR 5/4) loam; weak medium subangular blocky structure; friable; discontinuous thin dark brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

IIB31—36 to 46 inches; brown (7.5YR 5/4) loam; weak coarse subangular blocky structure; friable; strongly acid; clear wavy boundary.

IIB32—46 to 80 inches; reddish brown (5YR 5/4) sandy clay loam; weak coarse subangular blocky structure; friable and firm; very strongly acid.

The solum ranges from 48 to 84 inches in thickness. The loess cover ranges from 20 to 40 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The B2t horizon has hue of 7.5YR or, less commonly, 10YR, value of 4 or 5, and chroma of 4 to 6. It is medium acid to very strongly acid.

The IIB2 horizon has hue of 7.5YR, 5YR, or, occasionally, 2.5YR. It has value of 4 or 5 and chroma of 3 to 6. It is loam or sandy clay loam. In a few pedons the texture is clay loam.

Pekin series

The Pekin series consists of deep soils that are moderately well drained and very slowly permeable. These soils are on stream terraces. They formed in silty alluvium. Slopes range from 2 to 12 percent.

Pekin soils are similar to Otwell soils and are commonly adjacent to Bartle and Stendal soils. Unlike the Pekin soils, Otwell soils do not have mottles of 2 chroma in the upper 10 inches of the argillic horizon. The Otwell soils commonly have a higher clay content in the B horizon. Bartle soils have mottles of 2 chroma immediately below the Ap, are nearly level, and are on terraces. Stendal soils

do not have a developed B horizon and are on the flood plains.

Typical pedon of Pekin silt loam, 2 to 6 percent slopes, in a cultivated field, 590 feet north and 2,610 feet west of the southeast corner of sec. 12, T. 1 S., R. 4 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

B21t—8 to 15 inches; yellowish brown (10YR 5/6) silt loam; few medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; few fine roots; discontinuous thin yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

B22t—15 to 21 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct pale brown (10YR 6/3), light brownish gray (10YR 6/2), and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; discontinuous thin yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

B23t—21 to 25 inches; pale brown (10YR 6/3) silty clay loam; many medium faint light brownish gray (10YR 6/2) and many medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; discontinuous thin yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bx—25 to 44 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2), light gray (10YR 7/2), and yellowish brown (10YR 5/6) mottles; strong very coarse prismatic structure; very firm; patchy thin light gray (10YR 7/2) clay films on faces of peds; very strongly acid; clear wavy boundary.

B3—44 to 55 inches; brownish yellow (10YR 6/6) silt loam; many medium distinct light brownish gray (10YR 6/2), light gray (10YR 7/2), and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; very strongly acid; clear wavy boundary.

C—55 to 70 inches; brownish yellow (10YR 6/6) silty clay loam; many medium distinct pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable; medium acid; clear wavy boundary.

The solum ranges from 40 to 60 inches in thickness. A fragipan is at a depth of 24 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6.

The Bx horizon has hue of 10YR, color value of 5 or 6, and chroma of 2 to 6. It is silt loam or silty clay loam.

The C horizon is stratified silt loam, silty clay loam, loam, and fine sandy loam.

Peoga series

The Peoga series consists of deep soils that are poorly drained and slowly permeable. These soils are on loess-capped lake plains and low river terraces. They formed in silty and loamy materials of mixed origin. Slopes range from 0 to 2 percent.

Peoga soils are similar to Bonnie soils and are commonly adjacent to Bartle soils on the alluvial terraces and are adjacent to Dubois soils on the lake plains. Bonnie soils do not have an argillic horizon. Bartle and Dubois soils have dominant chroma of more than 2 in some subhorizons that are between the Ap horizon and a depth of 30 inches. They also have a well expressed fragipan. Bonnie soils are on the adjacent floodplains. Bartle and Dubois soils are on convex rises and around drainageways.

A typical pedon of Peoga silt loam, in a cultivated field, 620 feet west and 1,400 feet north of the southeast corner of sec. 13, T. 1 S., R. 6 W.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; few fine roots; few black (10YR 2/1) iron and manganese oxide accumulations; neutral; abrupt smooth boundary.

A2g—11 to 18 inches; gray (10YR 6/1) silt loam; common medium and coarse distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few black (10YR 2/1) iron and manganese oxide accumulations; medium acid; clear wavy boundary.

B21g—18 to 25 inches; light brownish gray (2.5Y 6/2) silt loam; many medium and coarse distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium and coarse subangular blocky; friable; few fine roots; few black (10YR 2/1) iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

B22tg—25 to 37 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine and medium distinct strong brown (7.5YR 5/6) mottles; moderate medium and coarse prismatic structure; firm; continuous light brownish gray (10YR 6/2) and patchy grayish brown (10YR 5/2) clay films on faces of peds; pockets of gray (10YR 6/1) silt loam in voids; many strong brown (7.5YR 5/6) and brownish yellow (10YR 6/6) iron and manganese oxide accumulations; very strongly acid; gradual wavy boundary.

Bx1g—37 to 54 inches; gray (5Y 5/1) silt loam; many medium and coarse distinct strong brown (7.5YR 5/6 & 5/8) mottles; strong coarse prismatic structure; very firm; continuous thick to thin gray (10YR 6/1) clay films on faces of peds; fillings of gray

(10YR 6/1) silt loam in krotovinas; strongly acid; gradual wavy boundary.

IIBx2—54 to 60 inches; yellowish brown (10YR 5/6) loam; strong coarse prismatic structure; very firm; continuous thin to thick gray (10YR 6/1) clay and silt films on faces of peds; strongly acid; clear wavy boundary.

IIB3—60 to 80 inches; strong brown (7.5YR 5/6) stratified sandy loam and sandy clay loam; common coarse distinct brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; friable; continuous thin to thick yellowish brown (10YR 5/4) silt films on faces of peds; slightly acid.

The solum ranges from 48 to 84 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2.

The B2 horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7; and chroma of 1 or 2. Some pedons have horizons that are brittle and very firm and are designated Bx horizons.

The B3 horizons are stratified loam, silt loam, silty clay loam, and sandy loam.

Petrolia series

The Petrolia series consists of deep soils that are poorly drained and moderately slowly permeable. These soils are on flood plains. They formed in moderately fine textured alluvium. Slopes range from 0 to 2 percent.

Petrolia soils are similar to Bonnie soils and are commonly adjacent to Chagrin and Nolin soils. Bonnie soils are more acid. Chagrin soils are fine loamy. Nolin soils have brighter colors in the profile. Chagrin and Nolin soils are on adjacent bottom lands at higher elevations.

A typical pedon of Petrolia silty clay loam, in a cultivated field, 1,740 feet east and 1,350 feet north of the southwest corner of sec. 22, T. 1 N., R. 6 W.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint dark gray (10YR 4/1) mottles; moderate medium granular structure; firm; many fine and medium roots; neutral; abrupt smooth boundary.

C1g—11 to 33 inches; gray (5Y 5/1) silty clay loam; many coarse faint dark gray (5Y 4/1) and common medium prominent dark brown (7.5YR 4/4) mottles; massive; firm; few fine roots; slightly acid; clear wavy boundary.

C2g—33 to 44 inches; gray (5Y 5/1) silty clay loam; many medium prominent dark brown (7.5YR 4/4) and few fine prominent strong brown (7.5YR 5/6) mottles; massive; firm; slightly acid; clear wavy boundary.

C3g—44 to 60 inches; gray (5Y 5/1) silty clay loam; few fine prominent strong brown (7.5YR 5/6) and common medium prominent dark brown (7.5YR 4/4) mottles; massive; firm; slightly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. A few pedons have surface horizons that have a value of 3.

The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 or 6; and chroma of less than 2. Mottles in this horizon have brighter chroma. The C horizon is neutral to medium acid. Thin strata of silt loam, clay loam, sandy loam, or loam are in some pedons.

Pike series

The Pike series consists of deep soils that are well drained and are moderately permeable. These soils are on loess-capped outwash and lake plains. They formed in loess and in loamy and sandy sediments. Slopes range from 0 to 6 percent.

Pike soils are similar to Parke soils and are commonly adjacent to Otwell and Negley soils in the landscape. Parke soils formed in less than 40 inches of loess and have more sand in the control section. Otwell soils are at slightly lower elevations and have a fragipan. Negley soils are fine loamy and developed in less than 20 inches of loess over sandy outwash materials. They are steeper than Pike soils.

A typical pedon of Pike silt loam, 0 to 2 percent slopes, in a cultivated field, 1,710 feet east and 480 feet south of the center of sec. 30, T. 1 S., R. 5 W.

Ap—0 to 10 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

B21t—10 to 22 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; continuous, thin brown (7.5YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—22 to 35 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; continuous thin brown (7.5YR 5/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B23t—35 to 48 inches; strong brown (7.5YR 5/6) silt loam; weak medium and fine subangular blocky structure; friable; continuous thin brown (7.5YR 5/4) clay films on faces of peds; discontinuous thin pinkish gray (7.5YR 6/2) silt coatings on faces of peds; strongly acid; clear wavy boundary.

IIB3—48 to 80 inches; red (2.5YR 4/6) sandy clay loam; weak coarse subangular blocky structure; firm; discontinuous thin red (2.5YR 4/6) clay films on sand grains and as bridging between sand grains; strongly acid.

The solum ranges from 60 to 96 inches in thickness. The loess ranges in depth from 40 to 60 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4.

The B2 horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. In a few pedons the hue is 10YR. Reaction is strongly acid or very strongly acid.

The IIB horizon is stratified loam and sandy clay loam and include strata of sandy loam and loamy sand.

Princeton series

The Princeton series consists of deep soils that are well drained and moderately permeable. These soils are on uplands. They formed in loamy and sandy deposits of eolian origin. Slopes range from 2 to 60 percent.

A typical pedon of Princeton fine sandy loam, 2 to 6 percent slopes, in a cultivated field, 1,900 feet east and 120 feet south of the northwest corner of sec. 26, T. 1 N., R. 6 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) fine sandy loam; weak very fine granular structure; very friable; common fine and medium roots; strongly acid; abrupt smooth boundary.

B21—9 to 17 inches; strong brown (7.5YR 5/6) loam; weak fine subangular blocky structure; friable; strongly acid; clear wavy boundary.

B22t—17 to 23 inches; yellowish red (5YR 5/6) loam; moderate medium subangular blocky structure; friable; discontinuous thin yellowish red (5YR 4/6) clay films on faces of peds; medium acid; clear wavy boundary.

B23t—23 to 32 inches; yellowish red (5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; firm; discontinuous thin yellowish red (5YR 5/6) clay films on faces of peds; strongly acid; clear wavy boundary.

B24t—32 to 42 inches; yellowish red (5YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; discontinuous thin yellowish red (5YR 4/6) clay films on faces of peds; strongly acid; clear wavy boundary.

B3—42 to 49 inches; strong brown (7.5YR 5/6) fine sandy loam; weak medium subangular blocky structure; very friable; strongly acid; clear wavy boundary.

C—49 to 60 inches; strong brown (7.5YR 5/6) loamy fine sand; single grained; loose; medium acid.

The solum ranges from 40 to 60 inches in thickness. It is medium acid to neutral.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is a loamy sand or loamy fine sand.

The B2 horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 4 to 6. It is fine sandy loam, sandy clay loam, or clay loam.

The C horizon is brown, stratified fine sand, loamy fine sand, sandy loam, and silt loam. It is slightly acid to moderately alkaline.

Steff series

The Steff series consists of deep soils that are moderately well drained and moderately permeable. These soils are on flood plains. They formed in acid, silty alluvium. Slopes range from 0 to 2 percent.

Steff soils are similar to Cuba soils and are commonly adjacent to Stendal soils. Unlike the Steff and Stendal soils, Cuba soils do not have gray mottles above 24 inches. Stendal soils have gray mottles directly below the Ap horizon and are in more nearly level to concave areas of the landscape.

Typical pedon of Steff silt loam, in a cultivated field, 1,380 feet west and 2,400 feet north of the southeast corner of sec. 7, T. 2 S., R. 4 W.

Ap—0 to 11 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

B21—11 to 20 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure parting to moderate medium granular; friable; few fine roots; very strongly acid; clear wavy boundary.

B22—20 to 26 inches; pale brown (10YR 6/3) silt loam; many medium faint light brownish gray (10YR 6/2) mottles and brown (10YR 5/3) and few fine distinct dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; few fine roots; strongly acid; gradual wavy boundary.

B23—26 to 38 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; very few fine roots; few dark brown (7.5YR 4/4) iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

B24—38 to 50 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common black (10YR 2/1) iron and manganese oxide accumulations mainly in the lower 4 inches of the horizon; very strongly acid; clear wavy boundary.

C1—50 to 59 inches; light brownish gray (10YR 6/2) silt loam; few fine distinct yellowish brown (10YR 5/8) mottles; massive; friable; very strongly acid; clear wavy boundary.

C2—59 to 70 inches; pale brown (10YR 6/3) and dark brown (7.5YR 4/4) silt loam; massive; friable; many black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid.

The solum ranges from 24 to 50 inches in thickness. The control section is strongly acid or very strongly acid.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The upper part of the B2 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. The lower part of the B2 horizon has hue of 10YR, value of 5 to 6, and chroma of 2 to 4. It has brighter colored mottles. Texture is silt loam or silty clay loam.

Stendal series

The Stendal series consists of deep soils that are somewhat poorly drained and moderately permeable. These soils are on flood plains. They formed in silty alluvium. Slopes range from 0 to 2 percent.

Stendal soils are similar to Bonnie soils and are commonly adjacent to Steff soils. Bonnie soils are grayer. Steff soils are browner, and are on slightly higher parts of the landscape or are adjacent to drainageways.

Typical pedon of Stendal silt loam, in a cultivated field, 2,380 feet south and 1,600 feet west of the northeast corner of sec. 7, T. 2 S., R. 4 W.

Ap—0 to 10 inches; yellowish brown (10YR 5/4) silt loam; few fine faint pale brown (10YR 6/3) mottles; moderate medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

C1—10 to 18 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct brown (10YR 5/3), gray (10YR 5/1) and yellowish brown (10YR 5/4) mottles; weak medium granular structure; friable; few fine roots; very strongly acid; clear wavy boundary.

C2—18 to 21 inches; pale brown (10YR 6/3) silt loam; many medium and coarse distinct yellowish brown (10YR 5/8) and light gray (10YR 7/2) mottles; massive; friable; few fine roots; very strongly acid; clear wavy boundary.

C3—21 to 37 inches; light gray (10YR 7/2) silt loam; many medium distinct yellowish brown (10YR 5/8) and light yellowish brown (10YR 6/4) mottles; massive; friable; few fine roots; continuous thin brown (10YR 5/3) silt coatings in old root and worm channels; very strongly acid; clear wavy boundary.

C4—37 to 53 inches; light gray (10YR 7/2) silt loam; many medium and coarse prominent yellowish brown (10YR 5/6) mottles; massive; friable; many black (10YR 2/1) and dark brown (7.5YR 4/4) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

C5—53 to 60 inches; gray (10YR 6/1) and light gray (10YR 7/2) silt loam and loam; many medium and coarse prominent yellowish brown (10YR 5/6) and brownish yellow (10YR 6/6) mottles; massive; friable; very strongly acid.

The control section is strongly acid or very strongly acid.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 3 and has mottles of brighter chroma. It is silt loam or silty clay loam but ranges to loam below a depth of 40 inches.

Tilsit series

The Tilsit series consists of deep soils that are moderately well drained and slowly permeable. These soils are on loess-capped uplands. They formed in loess and in residuum of the underlying siltstone, sandstone, or shale. Slopes range from 0 to 6 percent.

Tilsit soils are similar to Johnsburg and Zanesville soils and are commonly adjacent to Wellston soils in the landscape. Johnsburg soils have gray mottles within the upper 10 inches of the argillic horizon and within 16 inches of the surface. Zanesville soils have more than 35 percent base saturation and are brighter colored. Wellston soils do not have a fragipan and are on narrow, more sloping ridgetops.

Typical pedon of Tilsit silt loam, 2 to 6 percent slopes, in a cultivated field, 330 feet west and 1,010 feet north of the southeast corner of sec. 27, T. 1 N., R. 3 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

B21t—8 to 13 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; discontinuous thin yellowish brown (10YR 5/6) clay films on faces of peds; brown (10YR 4/3) silt loam material in old root and worm channels; medium acid; clear wavy boundary.

B22t—13 to 20 inches; yellowish brown (10YR 5/8) silt loam; few medium distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; discontinuous thin yellowish brown (10YR 5/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

B23t—20 to 25 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct pale brown (10YR 6/3), yellowish brown (10YR 5/8), light brownish gray (10YR 6/2), and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; discontinuous thin brown (10YR 5/3) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bx—25 to 46 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; moderate very coarse prismatic structure parting to

moderate medium subangular blocky; very firm; discontinuous thin light gray (10YR 7/2) silt coatings on faces of peds; grayish brown (2.5Y 5/2) clay filling between peds; very strongly acid; clear wavy boundary.

IIB3—46 to 60 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct light brownish gray (10YR 6/2) and many medium faint brownish yellow (10YR 6/6) mottles; massive; friable; very strongly acid; clear wavy boundary.

IIC—60 to 72 inches; brownish yellow (10YR 6/6) stratified channery loam, silt loam, and silty clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; massive; friable; 25 percent sandstone fragments that are 1/2 inch to 2 inches in length; very strongly acid.

IIR—72 inches; interbedded sandstone and shale bedrock.

The solum ranges from 40 to 60 inches in thickness. The fragipan is at a depth of 20 to 28 inches. Bedrock is at a depth of 60 to 90 inches and is stratified lithic or paralithic.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6.

The Bx horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. It is silt loam or silty clay loam.

Wellston series

The Wellston series consists of deep soils that are well drained and moderately permeable. These soils are on uplands. They formed in loess and in residuum of the underlying sandstone, siltstone, or shale. Slopes range from 6 to 12 percent.

Wellston soils are similar to the Alford and Pike soils and are commonly adjacent to Zanesville soils in the landscape. Alford and Pike soils formed in thicker loess. Alford soils have less sand in the lower part of the solum and Pike soils are redder in the lower part of the subsoil. Zanesville soils have a fragipan and are on wider ridges.

A typical pedon of Wellston silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 550 feet west and 2,120 feet south of the northeast corner of sec. 2, T. 1 S., R. 3 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; pockets of strong brown (7.5YR 5/8) material from the subsoil; moderate medium granular structure; friable; many fine and medium roots; slightly acid; abrupt smooth boundary.

B21t—7 to 26 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine and medium roots; continuous thin brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

B22t—26 to 32 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; discontinuous thin brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

IIB3—32 to 43 inches; yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; patchy thin brown (7.5YR 5/4) clay films on faces of peds; discontinuous thin light gray (10YR 7/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

IICr—43 inches; soft sandstone bedrock.

The solum ranges from 36 to 50 inches in thickness. Bedrock is at a depth of 40 to 60 inches and is stratified lithic or paralithic.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4.

The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6.

Zanesville series

The Zanesville series consists of deep soils that are well drained and slowly permeable. These soils are on loess-capped uplands. They formed in loess and in residuum of the underlying sandstone, siltstone, or shale. Slopes range from 6 to 12 percent.

Zanesville soils are similar to Otwell and Tilsit soils and are adjacent to Gilpin soils. In Otwell soils, the lower horizons formed in lacustrine or alluvial deposits. Tilsit soils have base saturation of less than 35 percent. Gilpin soils do not have a fragipan and are less than 40 inches deep to bedrock. They are steeper sloping and in adjacent areas.

Typical pedon of an uneroded Zanesville soil in an area of Zanesville silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 790 feet west and 810 feet south of the northeast corner of sec. 12, T. 1 S., R. 3 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many fine roots; many medium continuous pores; slightly acid; abrupt smooth boundary.

B1—9 to 13 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; many fine roots; many fine tubular pores; strongly acid; clear smooth boundary.

B21t—13 to 19 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; many fine tubular and vesicular pores; discontinuous thin strong brown (7.5YR 5/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

B22t—19 to 26 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; many fine tubular vesicular pores; very pale brown (10YR 7/3) thin discontinuous silt films, white (10YR 8/1) when dry; very strongly acid; clear wavy boundary.

B23t—26 to 32 inches; dark brown (7.5YR 4/4) silty clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium and coarse angular and subangular blocky; firm; few fine roots; common fine tubular and vesicular pores; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds and linings of some pores; thin continuous light gray (10YR 7/2) silt coatings on faces of peds, white (10YR 8/1) when dry; few fine black (10YR 2/1) iron and manganese oxide accumulations; very strongly acid; clear irregular boundary.

Bx1—32 to 47 inches; dark brown (7.5YR 4/4) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; very strong very coarse prismatic structure parting to moderate coarse angular blocky; very firm and brittle; common very fine tubular and vesicular pores; thin discontinuous gray (10YR 6/1) and dark brown (7.5YR 4/4) clay films on faces of peds and linings of pores; thin continuous light gray (10YR 7/1) silt coatings on faces of peds, white (10YR 8/1) when dry; very strongly acid; clear wavy boundary.

IIBx2—47 to 56 inches; light yellowish brown (10YR 6/4) silt loam; very strong very coarse prismatic structure; very firm and brittle; very few fine flat roots; common fine imped tubular and vesicular pores; thin to thick light brownish gray (10YR 6/2) clay films and silt coatings on faces of peds; common black (10YR 2/1) iron and manganese oxide accumulations; 5 to 10 percent sandstone fragments; very strongly acid; clear wavy boundary.

IIIC—56 to 79 inches; yellowish brown (10YR 5/6) silty clay; massive; very firm; few fine old roots; few fine tubular pores; thin light brownish gray (10YR 6/2) vertical streaks occurring as pore fillings; very strongly acid; clear wavy boundary.

IIICr—79 inches; light gray (N 7/0) soft clay shale; massive; very firm; few fine roots; light yellowish brown (2.5Y 6/4) vertical streaks in the upper part; strongly acid.

The solum ranges from 45 to 60 inches in thickness. The fragipan is at a depth of 24 to 32 inches. Bedrock is at a depth of 60 to 80 inches and is stratified lithic or paralithic.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2 horizon has hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam.

The Bx horizon has hue of 10YR and 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is silty clay loam, silt loam, or loam.

Formation of the soils

In this section the major factors of soil formation and their degree of importance in the formation of the soils in the county are discussed. Processes that influence the formation of soils are also described.

Factors of soil formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material

Parent material influences the textural, chemical, and mineralogical properties of soils. Parent material in Dubois County is variable. It consists of alluvial, lacustrine, lakebed, outwash, and eolian deposits and residuum of sandstone, siltstone, and shale.

Most soils in the survey area formed in material weathered from the underlying bedrock. The sedimentary rocks, or geologic formations, consist of alternate layers of sandstone, siltstone, and shale and range from a few feet to several feet of thickness. These formations have a downward tilt toward the west-southwest at a rate of about 25 feet per mile. Thus from the eastern part of the

area to the western part of the area, different ages and formations of rock are exposed.

In the extreme eastern edge of the area, rock formations of Late Mississippian age consist of interbedded shale, sandstone, siltstone, and limestone. Thin layers of limestone and sandstone are exposed on the hillsides. In the rest of the area, rock formations of Early Pennsylvanian age consists of interbedded sandstone, siltstone, and shale. Within these formations are thin layers of coal. In these areas the soils formed in residuum of sandstone, siltstone, and shale. Most of these soils have a thin mantle of loess. Soils of the Gilpin and Berks series formed in material weathered mainly from sandstone and shale.

In the northwestern part of the county, soils developed in lacustrine deposits of Illinoian age. As the glacial ice receded, lakes formed in the valleys that had been blocked by glacial drift. In these temporary glacial lakes, sands and silts were deposited by relatively fast moving melt water. Then as the ice further receded, the water flowed in slowly and only the finer material of clay and silt size was carried into these lakes to settle out. Examples of soils that formed in Illinoian glacial lake deposits are Dubois and Peoga soils.

Lacustrine soils in the White River Valley formed in material deposited by gacial drift of Wisconsin age. This material was carried down the existing valley by melt water, which backed up into the tributaries and deposited clays and silts. Examples of soils that formed in Wisconsin glacial lake deposits are McGary and Montgomery soils.

During Late Wisconsin time, loess was deposited over the entire area. This mantle of loess, which ranges from a few inches to several feet in thickness, contributed much toward the development of the soils in the county. Most of the silt was washed away on the steeper soils but on the less sloping soils it remained and is a part of the soil profile. The Alford soil is an example of a soil that formed in over 5 feet of loess, and the Zanesville soil is an example of a soil that formed in loess over residuum of sandstone, siltstone, or shale.

A coarser textured material, primarily of sand size, was carried by the wind out of the White River Valley and deposited on the adjacent uplands. This material is of Wisconsin age and was first deposited in the valley by glacial melt water. It ranges up to several feet in thickness. The Princeton soil is an example of a soil developed in this material.

Sediments deposited by water are the parent materials of the soils on bottom lands and on terraces along the many drainageways that dissect the county. Stendal and Cuba soils on bottom lands and Bartle and Pekin soils on terraces are examples of soils that developed in sediments deposited by water.

Plant and animal life

Before Dubois County was settled, the native vegetation was most important in the complex of living organisms that affected soil development. Plants, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its morphology. Micro-organisms, such as bacteria and fungi, cause raw plant waste to decompose into organic matter and to be incorporated into the soil. The higher forms of plants return organic matter to the soil and bring moisture and plant nutrients from the lower part of the soil to the upper part.

The native vegetation of the area consists largely of hardwood trees. The most common species are tulip-poplar, oak, hickory, elm, maple, and ash. Only a small amount of organic matter derived from trees was incorporated into the soils while they were forming. In uplands that have never been cleared, thin layers of forest litter and leaf mold cover the soil, and a small amount of organic matter from decayed leaves and twigs is mixed throughout the top 1 or 2 inches of the surface layer. In areas of Montgomery soils, the native vegetation included swamp grasses and sedges, as well as water-tolerant trees. These soils were covered with water much of the year. As the organic material fell, it decayed slowly so that there was some accumulation.

The native vegetation was fairly uniform throughout the county, and major differences in most soils cannot be explained on the basis of differences in vegetation. Although some comparatively minor variations in the vegetation are associated with different soils, the variations are probably chiefly the result, and not the cause, of the differences among the soils.

Climate

The climate of Dubois County is midcontinental and is characterized by a wide range in temperature. The average daily maximum temperature is 87.0 degrees F in July, and the average daily minimum temperature is 19.0 degrees in January. Generally, the weather is excessively hot in midsummer.

Rainfall is moderately heavy and averages 44.88 inches annually. It is well distributed throughout the year but is slightly greater in spring and summer than in fall and winter. The large amount of rainfall has leached plant nutrients from the surface layer and has prevented the accumulation of calcium carbonate.

The climate is so nearly uniform throughout the county that differences among the soils cannot be explained on the basis of differences in climate alone. Climatic forces act upon rocks to form the parent materials in which soils are formed, but many of the more important soil characteristics would not develop except for the activity of plant and animal life. Without the changes brought about by the presence of plants and animals, the soils would consist merely of residual or transported materials derived from weathered rock. Some, however, might

have definite layers formed by additions of material from differential weathering or leaching.

Climate, acting alone on the parent material, would be largely destructive. It would cause the soluble materials to be washed out of the soils. When combined with the activities of plants and animals, the processes of climate become constructive. A cycle is established between intake and outgo of plant nutrients. Plants draw nutrients from the lower part of the soil through the roots; then, when the plants die, the plant nutrients are returned to the upper part of the soil. In Dubois County the climate is such that leaching of nutrients is greater than replacement, and most of the soils undergo strong weathering and leaching to become acid and low in fertility.

More information about the climate is given in the section "General nature of the county."

Relief

The relief in Dubois County ranges from nearly level on bottom lands, terraces, and upland flats to very steep on side slopes. Much of the survey area has been highly dissected by weathering and stream cutting. Relief has affected drainage and the development of the soils mainly through its influence on depth to the water table, runoff, and water erosion. Differences in relief have radically affected moisture and air within the soil.

Soils of the same type of parent material are less strongly developed in steep areas than those in nearly level to sloping areas. This weak soil formation is caused by (1) rapid normal erosion, (2) the reduced percolation of water through the soil material, and (3) lack of sufficient water in the soil to support a vigorous growth of plants. The degree of horizon development within a given time, from a given parent material, and under the same type of vegetation depends largely on the amount of water that passes through the soil material.

In Dubois County, different soils have formed from the same kind of parent material because of variations in relief. A good example of how relief has affected the soil horizon development in the same parent material is shown by comparing the Dubois and Otwell soils. Soils of both series formed in loess and the underlying lacustrine deposits. The Dubois soils are nearly level, somewhat poorly drained, and are gray and mottled in the upper part of the subsoil. The Otwell soils are moderately sloping and well drained and are strong brown in the upper part of the subsoil.

Time

Generally, the soil horizons are more fully developed where the parent material has remained in place for the longer time. Because of differences in parent material, relief, and climate, some soils mature more slowly than others. The soils on bottom lands and in local alluvial and colluvial areas are immature because the parent materials are young and new material is deposited periodically. Soils on steep slopes are likely to be immature because geologic erosion removes the soil material nearly as fast as it forms from parent materials. Also, runoff is greater on steep slopes and less water percolates down through the soil material. A mature soil is one that has a well developed A and B horizon that was produced by the natural processes of soil formation. An immature or young soil has little or no horizon differentiation.

In Dubois County, the oldest soils are those formed in residuum of sandstone, siltstone, and shale. Such soils as Zanesville and Tilsit soils have well developed horizons and are considered to be mature. The young soils are those on bottom lands where new materials are deposited periodically. Such soils as Cuba and Stendal soils are considered immature. There are also young soils such as Berks soils on steep slopes, where natural erosion is nearly as rapid as soil formation.

Process of soil formation

Several processes have been involved in the formation of the soils of this county. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all soils of this county. The organic matter content of some soils is low, but that of others is high. Generally, the soils that have the most organic matter, for example soils of the Montgomery series, have a thick, black surface horizon.

Carbonates and bases have been leached from the upper horizons of nearly all the soils of this county. Leaching is generally believed to precede the translocation of the silicate clay minerals. Most all of the carbonates and some of the bases have been leached from the A and B horizons of well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid reaction. Leaching of wet soils is slow because of a high water table or because water moves slowly through such soils.

Clay particles accumulate in pores and other voids and form films on the surfaces along which water moves. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils of this county. Soils of the Wellston series are examples of soils in which translocated silicate clays have accumulated in the B2t horizon in the form of clay films.

The reduction and transfer of iron, or gleying, has occurred in all of the very poorly drained and somewhat poorly drained soils of this county. In the naturally wet soils, this process has been significant in horizon differentiation. The gray color of the subsoil indicates the

redistribution of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are in some horizons, indicate segregation of iron.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that is is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope

and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified

size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1971 to 1974 at Paoli, Indiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	40.3	19.0	29.7	69	-14	0	3.55	2.00	4.80	7	5.3
February----	44.1	21.2	32.7	71	-10	7	3.23	1.52	4.61	7	4.0
March-------	52.6	29.2	40.9	81	7	41	4.64	2.50	6.38	9	3.8
April-------	66.4	41.0	53.8	86	20	160	4.38	2.65	5.93	9	.2
May---------	75.7	49.6	62.7	92	28	400	4.47	2.70	6.04	8	.0
June--------	83.6	58.7	71.2	97	40	636	4.34	2.39	5.92	8	.0
July--------	87.0	62.3	74.7	98	45	766	4.45	2.77	5.95	7	.0
August------	86.5	59.7	73.2	98	43	719	3.25	1.72	4.49	5	.0
September---	80.6	53.0	67.0	95	33	510	2.87	1.45	4.02	5	.0
October-----	69.9	40.2	55.0	88	20	194	2.55	1.06	3.74	5	.0
November----	54.7	30.7	42.8	80	8	9	3.65	2.11	4.91	7	1.5
December----	43.7	23.1	33.4	70	-6	14	3.50	1.84	4.85	7	2.6
Year------	65.4	40.6	53.1	101	-16	3,456	44.88	38.98	49.66	84	17.4

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951 to 1974 at Paoli, Indiana]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 17	May 7	May 17
2 years in 10 later than--	April 13	April 30	May 11
5 years in 10 later than--	April 6	April 18	April 30
First freezing temperature in fall:			
1 year in 10 earlier than--	October 17	October 4	September 26
2 years in 10 earlier than--	October 21	October 8	September 30
5 years in 10 earlier than--	October 29	October 17	October 7

TABLE 3.--GROWING SEASON

[Recorded in the period 1951 to 1974 at Paoli, Indiana]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	190	160	139
8 years in 10	195	167	146
5 years in 10	206	181	159
2 years in 10	217	195	172
1 year in 10	222	202	179

TABLE 4.--POTENTIALS AND LIMITATIONS OF GENERAL SOIL MAP UNITS FOR SPECIFIED USES

Map unit	Percentage of county	Cultivated crops	Pasture and hayland	Woodland	Urban uses	Intensive recreation areas
Gilpin-Zanesville-Berks	28	Poor: slope.	Fair: slope.	Good	Poor: slope, depth to rock.	Poor: slope.
Zanesville-Gilpin-Tilsit	44	Fair: slope.	Good	Good	Fair: slope, wetness, permeability.	Fair: slope, wetness.
Stendal-Steff-Cuba	14	Good	Good	Good	Poor: wetness, floods.	Fair: wetness, floods.
Otwell-Dubois-Peoga	11	Good	Good	Good	Poor: wetness.	Fair: wetness.
Pike-Negley-Parke	2	Fair: slope.	Good	Good	Fair: slope.	Fair: slope.
Alford-Princeton	1	Fair: slope.	Good	Good	Fair: slope.	Fair: slope.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AfB	Alford silt loam, 2 to 6 percent slopes	386	0.1
AfC2	Alford silt loam, 6 to 12 percent slopes, eroded	233	0.1
AfE2	Alford silt loam, 15 to 25 percent slopes, eroded	232	0.1
Ba	Bartle silt loam	1,115	0.4
Bo	Bonnie silt loam	6,374	2.3
Bu	Burnside silt loam	1,804	0.7
Ch	Chagrin silt loam	604	0.2
Cu	Cuba silt loam	6,240	2.3
DuA	Dubois silt loam, 0 to 2 percent slopes	4,573	1.7
DuB	Dubois silt loam, 2 to 6 percent slopes	450	0.2
GlD2	Gilpin silt loam, 12 to 18 percent slopes, eroded	24,532	8.8
GlD3	Gilpin silt loam, 12 to 18 percent slopes, severely eroded	34,192	12.3
GlE	Gilpin silt loam, 18 to 25 percent slopes	15,713	5.7
GlE3	Gilpin silt loam, 18 to 25 percent slopes, severely eroded	4,119	1.5
GoF	Gilpin-Berks complex, 20 to 50 percent slopes	21,502	7.7
GuD	Gilpin-Orthents complex, 12 to 25 percent slopes	402	0.1
JoA	Johnsburg silt loam, 0 to 2 percent slopes	346	0.1
MgA	McGary silt loam, 0 to 2 percent slopes	323	0.1
Mo	Montgomery silty clay loam	89	*
NeD3	Negley loam, 12 to 18 percent slopes, severely eroded	1,638	0.6
NeF	Negley loam, 18 to 50 percent slopes	1,024	0.4
NgC2	Negley silt loam, 6 to 12 percent slopes, eroded	528	0.2
NgD2	Negley silt loam, 12 to 18 percent slopes, eroded	865	0.3
No	Nolin silt loam	1,332	0.5
OrD	Orthents, 6 to 25 percent slopes	574	0.2
OtA	Otwell silt loam, 0 to 2 percent slopes	2,687	1.0
OtB	Otwell silt loam, 2 to 6 percent slopes	6,848	2.5
OtC2	Otwell silt loam, 6 to 12 percent slopes, eroded	4,486	1.6
PaB	Parke silt loam, 2 to 6 percent slopes	908	0.3
PaC2	Parke silt loam, 6 to 12 percent slopes, eroded	1,167	0.4
PaD3	Parke silt loam, 12 to 18 percent slopes, severely eroded	882	0.3
PeB	Pekin silt loam, 2 to 6 percent slopes	2,918	1.1
PeC2	Pekin silt loam, 6 to 12 percent slopes, eroded	472	0.2
Pg	Peoga silt loam	4,108	1.5
Ph	Petrolia silty clay loam	649	0.2
PkA	Pike silt loam, 0 to 2 percent slopes	2,710	1.0
PkB	Pike silt loam, 2 to 6 percent slopes	1,195	0.4
PrB	Princeton fine sandy loam, 2 to 6 percent slopes	202	0.1
PrC	Princeton fine sandy loam, 6 to 12 percent slopes	315	0.1
PrF	Princeton fine sandy loam, 20 to 60 percent slopes	308	0.1
Sf	Steff silt loam	10,181	3.7
St	Stendal silt loam	27,646	10.0
TlA	Tilsit silt loam, 0 to 2 percent slopes	1,212	0.4
TlB	Tilsit silt loam, 2 to 6 percent slopes	21,116	7.6
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded	3,046	1.1
WeC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded	684	0.2
ZnC2	Zanesville silt loam, 6 to 12 percent slopes, eroded	47,951	17.3
ZnC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	2,754	1.0
	Water	3,485	1.3
	Total	277,120	100.0

* Less than 0.1 percent.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
AfB: Alford	120	42	48	4.0	8.0
AfC2: Alford	110	38	44	3.6	7.2
AfE2: Alford	---	---	---	2.8	5.6
Ba: Bartle	110	38	50	3.6	7.2
Bo: Bonnie	90	32	40	3.8	5.5
Bu: Burnside	82	29	36	3.5	6.0
Ch: Chagrin	120	42	48	4.0	8.0
Cu: Cuba	120	42	48	4.0	8.0
DuA: Dubois	110	38	50	3.6	7.2
DuB: Dubois	110	38	50	3.6	7.2
GlD2: Gilpin	---	---	35	2.5	6.0
GlD3: Gilpin	---	---	---	2.0	5.0
GlE: Gilpin	---	---	---	2.5	6.0
GlE3: Gilpin	---	---	---	---	---
GoF: Gilpin-Berks	---	---	---	---	---
GuD: Gilpin-Orthents	---	---	---	---	---
JoA: Johnsburg	100	35	45	3.3	6.6
MgA: McGary	100	35	45	2.3	4.6
Mo: Montgomery	120	42	48	4.0	8.0
NeD3: Negley	---	---	---	2.0	4.5
NeF: Negley	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
NgC2 Negley	90	30	40	3.0	5.5
NgD2 Negley	75	15	30	2.5	5.5
No Nolin	125	45	45	4.5	8.5
OrD** Orthents	---	---	---	3.5	6.0
OtA Otwell	105	37	47	3.4	6.8
OtB Otwell	105	37	47	3.4	6.8
OtC2 Otwell	85	30	38	2.8	5.6
PaB Parke	115	40	46	3.8	7.6
PaC2 Parke	105	37	42	3.4	6.8
PaD3 Parke	---	---	34	2.8	5.6
PeB Pekin	105	37	46	3.4	6.8
PeC2 Pekin	85	30	38	2.8	5.6
Pg Peoga	125	44	50	4.1	8.2
Ph Petrolia	120	38	45	4.2	6.5
PkA Pike	120	42	48	4.0	8.0
PkB Pike	120	42	48	4.0	8.0
PrB Princeton	95	33	43	3.1	6.2
PrC Princeton	85	30	38	2.8	5.6
PrF Princeton	---	---	---	2.0	3.0
Sf Steff	120	45	45	5.0	9.0
St Stendal	130	46	52	4.3	8.6
TlA Tilsit	100	30	40	3.0	6.5
TlB Tilsit	100	30	40	3.0	6.5

See footnotes at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
WeC2----------------------- Wellston	100	36	40	4.5	7.5
WeC3----------------------- Wellston	90	33	30	4.0	7.0
ZnC2----------------------- Zanesville	80	30	35	3.0	6.0
ZnC3----------------------- Zanesville	70	26	30	2.6	5.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	2,710	---	---	---	---
II	91,763	33,573	55,936	2,254	---
III	69,741	58,198	11,543	---	---
IV	28,835	28,835	---	---	---
V	---	---	---	---	---
VI	57,350	57,350	---	---	---
VII	23,236	23,236	---	---	---
VIII	---	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
AfB, AfC2 Alford	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
AfE2 Alford	1r	Moderate	Moderate	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
Ba Bartle	3o	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Sweetgum	75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
Bo Bonnie	2w	Slight	Severe	Severe	Severe	Pin oak Eastern cottonwood Sweetgum American sycamore	90 100 --- ---	Eastern cottonwood, red maple, American sycamore, sweetgum, baldcypress, pin oak.
Bu Burnside	1o	Slight	Slight	Slight	Slight	Eastern cottonwood Yellow-poplar American sycamore Sweetgum Northern red oak	106 96 --- --- ---	Black walnut, American sycamore, eastern cottonwood, pin oak, red maple.
Ch Chagrin	1o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar Sugar maple	86 96 85	Eastern white pine, black walnut, yellow-poplar, white ash.
Cu Cuba	1o	Slight	Slight	Slight	Slight	Yellow-poplar	100	Eastern white pine, black walnut, yellow-poplar, black locust.
DuA, DuB Dubois	3d	Slight	Slight	Moderate	Moderate	White oak Pin oak Yellow-poplar Sweetgum Northern red oak	--- --- --- --- ---	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
GlD2, GlD3, GlE, GlE3 Gilpin	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar	80 95	Virginia pine, eastern white pine, black cherry, yellow-poplar.
GoF*: Gilpin	2r	Severe	Severe	Slight	Slight	Northern red oak Yellow-poplar	80 95	Virginia pine, eastern white pine, black cherry, yellow-poplar.
Berks	3f	Moderate	Severe	Moderate	Slight	Northern red oak Black oak Virginia pine	70 70 70	Virginia pine, eastern white pine, red pine.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
GuD*:								
Gilpin	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar	80 95	Japanese larch, Virginia pine, eastern white pine, black cherry, yellow-poplar.
Orthents.								
JoA Johnsburg	3o	Slight	Slight	Slight	Slight	White oak Northern red oak Pin oak Yellow-poplar Sweetgum	70 75 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
MgA McGary	3c	Slight	Slight	Severe	Severe	White oak Pin oak Yellow-poplar Sweetgum	70 85 85 80	Eastern white pine, baldcypress, white ash, red maple, yellow-poplar, American sycamore.
Mo Montgomery	2w	Slight	Severe	Severe	Severe	Pin oak White oak Sweetgum	88 75 90	Eastern white pine, baldcypress, Norway spruce, red maple, white ash, sweetgum.
NeD3, NeF Negley	1r	Moderate	Moderate	Slight	Slight	Yellow-poplar Northern red oak	99 94	Eastern white pine, black walnut, yellow-poplar, red pine.
NgC2 Negley	1o	Slight	Slight	Slight	Slight	Yellow-poplar Northern red oak	99 94	Eastern white pine, black walnut, yellow-poplar, red pine.
NgD2 Negley	1r	Moderate	Moderate	Slight	Slight	Yellow-poplar Northern red oak	99 94	Eastern white pine, black walnut, yellow-poplar, red pine.
No Nolin	1o	Slight	Slight	Slight	Slight	Sweetgum	95	Sweetgum, yellow-poplar, eastern white pine, eastern cottonwood, cherrybark oak, white ash.
OtA, OtB, OtC2 Otwell	3d	Slight	Slight	Moderate	Moderate	White oak Yellow-poplar Sugar maple	--- --- ---	Eastern white pine, red pine, yellow-poplar, white ash.
PaB, PaC2, PaD3 Parke	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
PeB, PeC2 Pekin	3o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Virginia pine Sugar maple	70 85 75 75	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash.
Pg Peoga	2w	Slight	Severe	Severe	Moderate	Pin oak White oak Sweetgum	90 75 90	Eastern white pine, baldcypress, Norway spruce, red maple, white ash, sweetgum.
Ph Petrolia	2w	Slight	Moderate	Moderate	Slight	Eastern cottonwood Pin oak Sweetgum American sycamore	100 90 --- ---	Eastern cottonwood, red maple, American sycamore, baldcypress, water tupelo.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
PkA, PkB----------- Pike	1o	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum-----------	90 98 76	Eastern white pine, red pine, black walnut, black locust, yellow-poplar, white ash.
PrB, PrC----------- Princeton	1o	Slight	Slight	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum-----------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
PrF---------------- Princeton	1r	Severe	Severe	Slight	Slight	White oak----------- Yellow-poplar------- Sweetgum-----------	90 98 76	Eastern white pine, red pine, black walnut, yellow-poplar, white ash, black locust.
Sf----------------- Steff	1o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar-------	80 95	Yellow-poplar, eastern white pine, loblolly pine, sweetgum, black walnut.
St----------------- Stendal	2w	Slight	Moderate	Slight	Slight	Pin oak------------- Sweetgum------------ Yellow-poplar------- Virginia pine-------	90 85 90 90	Eastern white pine, baldcypress, American sycamore, red maple, white ash, yellow-poplar.
TlA, TlB----------- Tilsit	3o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Eastern white pine-- Virginia pine------- Shortleaf pine------	70 89 80 70 78	Eastern white pine, Virginia pine, shortleaf pine, yellow-poplar.
WeC2, WeC3--------- Wellston	2o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine-------	71 90 70	Eastern white pine, black walnut, yellow-poplar.
ZnC2--------------- Zanesville	3o	Slight	Slight	Slight	Slight	Northern red oak---- Virginia pine-------	68 70	Virginia pine, eastern white pine, shortleaf pine, yellow-poplar.
ZnC3--------------- Zanesville	4d	Slight	Slight	Moderate	Slight	Northern red oak---- Virginia pine-------	60 70	Virginia pine, shortleaf pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AfB------------------- Alford	Slight---------	Slight---------	Moderate: slope.	Severe: erodes easily.	Slight.
AfC2------------------ Alford	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
AfE2------------------ Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Ba-------------------- Bartle	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
Bo-------------------- Bonnie	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: floods, wetness.
Bu-------------------- Burnside	Severe: floods.	Slight---------	Moderate: floods, depth to rock.	Slight-----------	Moderate: floods, thin layer.
Ch-------------------- Chagrin	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
Cu-------------------- Cuba	Severe: floods.	Slight---------	Moderate: floods.	Severe: erodes easily.	Moderate: floods.
DuA, DuB-------------- Dubois	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
GlD2, GlD3, GlE, GlE3- Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
GoF*:					
Gilpin----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Berks-----------------	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.	Severe: slope.
GuD*:					
Gilpin----------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Orthents.					
JoA------------------- Johnsburg	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
MgA------------------- McGary	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
Mo-------------------- Montgomery	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, erodes easily.	Severe: ponding.
NeD3------------------ Negley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
NeF------------------- Negley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
NgC2------------------ Negley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope, small stones.
NgD2------------------ Negley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
No-------------------- Nolin	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.	Severe: floods.
OrD*. Orthents					
OtA, OtB-------------- Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
OtC2------------------ Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
PaB------------------- Parke	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.
PaC2------------------ Parke	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
PaD3------------------ Parke	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
PeB------------------- Pekin	Severe: floods, percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
PeC2------------------ Pekin	Severe: floods, percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
Pg-------------------- Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.	Severe: wetness.
Ph-------------------- Petrolia	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
PkA, PkB-------------- Pike	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
PrB------------------- Princeton	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
PrC------------------- Princeton	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
PrF------------------- Princeton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sf-------------------- Steff	Severe: floods.	Moderate: floods, wetness.	Severe: floods.	Moderate: floods.	Severe: floods.
St-------------------- Stendal	Severe: floods.	Moderate: floods, wetness.	Severe: floods.	Moderate: floods, wetness.	Severe: floods.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
TlA: Tilsit	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: percs slowly, wetness.	Severe: erodes easily.	Moderate: wetness.
TlB: Tilsit	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.
WeC2, WeC3: Wellston	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
ZnC2, ZnC3: Zanesville	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AfB: Alford	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AfC2: Alford	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AfE2: Alford	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ba: Bartle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Bo: Bonnie	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Bu: Burnside	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Cn: Chagrin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Cu: Cuba	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
DuA: Dubois	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
DuB: Dubois	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
GlD2, GlD3, GlE, GlE3: Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
GoF*:										
Gilpin	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Berks	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
GuD*:										
Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Orthents.										
JoA: Johnsburg	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
MgA: McGary	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Mo: Montgomery	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
NeD3: Negley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
NeF: Negley	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
NgC2: Negley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NgD2: Negley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
No: Nolin	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Fair	Very poor.
OrD*. Orthents										
OtA, OtB: Otwell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OtC2: Otwell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PaB: Parke	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PaC2: Parke	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PaD3: Parke	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
PeB: Pekin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeC2: Pekin	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Pg: Peoga	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Ph: Petrolia	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
PkA, PkB: Pike	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PrB: Princeton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PrC: Princeton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
PrF: Princeton	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Sf: Steff	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
St: Stendal	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
TlA: Tilsit	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
TlB: Tilsit	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WeC2, WeC3: Wellston	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
ZnC2, ZnC3---------- Zanesville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AfB: Alford	Slight	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, slope, low strength.	Severe: low strength, frost action.	Slight.
AfC2: Alford	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
AfE2: Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
Ba: Bartle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
Bo: Bonnie	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, frost action, floods.	Severe: floods, wetness.
Bu: Burnside	Severe: large stones.	Severe: floods.	Severe: floods, depth to rock.	Severe: floods.	Severe: floods.	Moderate: floods, thin layer.
Ch: Chagrin	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Cu: Cuba	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.	Moderate: floods.
DuA, DuB: Dubois	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
GlD2, GlD3, GlE, GlE3: Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GoF*:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Berks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GuD*:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Orthents.						
JoA: Johnsburg	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
MgA: McGary	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Mo----------------- Montgomery	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
NeD3, NeF--------- Negley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
NgC2-------------- Negley	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, low strength, slope.	Moderate: slope, small stones.
NgD2-------------- Negley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
No----------------- Nolin	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.	Severe: floods.
OrD*. Orthents						
OtA--------------- Otwell	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
OtB--------------- Otwell	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
OtC2-------------- Otwell	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
PaB--------------- Parke	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
PaC2-------------- Parke	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
PaD3-------------- Parke	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
PeB--------------- Pekin	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action.	Slight.
PeC2-------------- Pekin	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods, slope.	Severe: frost action.	Moderate: slope.
Pg---------------- Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
Ph---------------- Petrolia	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, low strength, wetness.	Severe: wetness, floods.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
PkA, PkB---------- Pike	Slight---------	Slight---------	Slight---------	Slight---------	Severe: frost action, low strength.	Slight.
PrB--------------- Princeton	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
PrC--------------- Princeton	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
PrF--------------- Princeton	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sf---------------- Steff	Severe: wetness.	Severe: floods.	Severe: floods. wetness.	Severe: floods.	Severe: floods, frost action.	Severe: floods.
St---------------- Stendal	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods.
TlA--------------- Tilsit	Moderate: wetness, depth to rock.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Moderate: wetness.
TlB--------------- Tilsit	Moderate: wetness, depth to rock.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: low strength, frost action.	Moderate: wetness.
WeC2, WeC3-------- Wellston	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
ZnC2, ZnC3-------- Zanesville	Moderate: slope, wetness, depth to rock.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Severe: frost action.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AfB----------------- Alford	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
AfC2---------------- Alford	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
AfE2---------------- Alford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ba------------------ Bartle	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Bo------------------ Bonnie	Severe: floods, percs slowly, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Bu------------------ Burnside	Severe: floods, depth to rock, wetness.	Severe: floods, depth to rock, wetness.	Severe: floods, depth to rock, wetness.	Severe: floods, wetness.	Poor: large stones, small stones.
Ch------------------ Chagrin	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Good.
Cu------------------ Cuba	Severe: floods.	Severe: floods.	Severe: floods, too sandy.	Severe: floods.	Poor: too sandy.
DuA, DuB------------ Dubois	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
GlD2, GlD3, GlE, GlE3---------------- Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
GoF*: Gilpin--------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Berks---------------	Severe: depth to rock, slope.	Severe: slope, seepage, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: seepage, slope.	Poor: small stones, slope.
GuD*: Gilpin--------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
Orthents.					
JoA----------------- Johnsburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock, wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MgA------------------ McGary	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Mo------------------ Montgomery	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
NeD3---------------- Negley	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
NeF------------------ Negley	Severe: slope.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: slope, seepage.	Poor: slope.
NgC2---------------- Negley	Moderate: slope, percs slowly.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones, slope, too clayey.
NgD2---------------- Negley	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope, seepage.	Poor: slope.
No------------------ Nolin	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Fair: wetness.
OrD*. Orthents					
OtA----------------- Otwell	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, too clayey.	Slight-----------	Fair: too clayey, thin layer.
OtB----------------- Otwell	Severe: wetness, percs slowly.	Moderate: slope, wetness.	Moderate: wetness, too clayey.	Slight-----------	Fair: too clayey, thin layer.
OtC2---------------- Otwell	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, thin layer.
PaB----------------- Parke	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
PaC2---------------- Parke	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
PaD3---------------- Parke	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
PeB----------------- Pekin	Severe: wetness, percs slowly.	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
PeC2---------------- Pekin	Severe: wetness, percs slowly.	Severe: floods, slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, slope, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Pg: Peoga	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ph: Petrolia	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
PkA: Pike	Slight	Moderate: seepage.	Severe: seepage.	Slight	Fair: too clayey.
PkB: Pike	Slight	Moderate: seepage, slope.	Severe: seepage.	Slight	Fair: too clayey.
PrB: Princeton	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
PrC: Princeton	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Fair: slope.
PrF: Princeton	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
Sf: Steff	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Severe: floods, wetness, seepage.	Fair: wetness.
St: Stendal	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
TlA: Tilsit	Severe: percs slowly, wetness.	Moderate: depth to rock, seepage.	Severe: depth to rock, wetness.	Moderate: wetness, depth to rock.	Fair: too clayey, wetness.
TlB: Tilsit	Severe: percs slowly, wetness.	Moderate: slope, seepage, depth to rock.	Severe: depth to rock, wetness.	Moderate: wetness, depth to rock.	Fair: too clayey, wetness.
WeC2, WeC3: Wellston	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, small stones, slope.
ZnC2, ZnC3: Zanesville	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: depth to rock.	Moderate: slope, wetness.	Fair: slope, too clayey, thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AfB: Alford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
AfC2: Alford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
AfE2: Alford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ba: Bartle	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Bo: Bonnie	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Bu: Burnside	Fair: area reclaim, low strength.	Improbable: thin layer, excess fines.	Improbable: thin layer, excess fines.	Fair: area reclaim.
Ch: Chagrin	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cu: Cuba	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
DuA, DuB: Dubois	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
GlD2, GlD3, GlE, GlE3: Gilpin	Poor: thin layer, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
GoF*:				
Gilpin	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Berks	Poor: slope, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
GuD*:				
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Orthents.				
JoA: Johnsburg	Fair: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MgA: McGary	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Mo: Montgomery	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
NeD3: Negley	Fair: slope, low strength.	Probable	Improbable: excess fines.	Poor: small stones, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
NeF: Negley	Poor: slope.	Probable	Improbable: excess fines.	Poor: small stones, slope.
NgC2: Negley	Fair: low strength.	Probable	Improbable: excess fines.	Poor: small stones.
NgD2: Negley	Fair: slope, low strength.	Probable	Improbable: excess fines.	Poor: small stones, slope.
No: Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
OrD*. Orthents				
OtA, OtB: Otwell	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
OtC2: Otwell	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
PaB: Parke	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
PaC2: Parke	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
PaD3: Parke	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
PeB: Pekin	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
PeC2: Pekin	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Pg: Peoga	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ph: Petrolia	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
PkA, PkB: Pike	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
PrB: Princeton	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
PrC: Princeton	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
PrF: Princeton	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sf: Steff	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
St: Stendal	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TlA, TlB: Tilsit	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
WeC2, WeC3: Wellston	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
ZnC2, ZnC3: Zanesville	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AfB---------------- Alford	Seepage, slope.	Favorable------	No water-------	Deep to water	Erodes easily	Erodes easily.
AfC2, AfE2-------- Alford	Slope----------	Favorable------	No water-------	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Ba---------------- Bartle	Seepage--------	Piping, wetness.	No water-------	Percs slowly, frost action.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
Bo---------------- Bonnie	Favorable------	Wetness, piping.	Slow refill----	Floods, frost action, percs slowly.	Favorable------	Wetness, erodes easily, percs slowly.
Bu---------------- Burnside	Seepage, depth to rock.	Seepage--------	Deep to water, slow refill.	Deep to water	Favorable------	Erodes easily, large stones, depth to rock.
Ch---------------- Chagrin	Seepage--------	Piping, seepage.	Deep to water, slow refill.	Deep to water	Favorable------	Favorable.
Cu---------------- Cuba	Seepage--------	Piping---------	No water-------	Deep to water	Erodes easily, too sandy.	Erodes easily.
DuA--------------- Dubois	Favorable------	Piping, wetness.	Slow refill----	Percs slowly, frost action.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
DuB--------------- Dubois	Slope----------	Piping, wetness.	Slow refill----	Percs slowly, frost action, slope.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
GlD2, GlD3, GlE, GlE3------------- Gilpin	Slope, depth to rock, seepage.	Thin layer, piping.	No water-------	Deep to water	Slope, depth to rock.	Slope, depth to rock.
GoF*: Gilpin-----------	Slope, depth to rock, seepage.	Thin layer, piping.	No water-------	Deep to water	Slope, depth to rock.	Slope, depth to rock.
Berks------------	Depth to rock, seepage.	Piping---------	No water-------	Deep to water	Depth to rock	Depth to rock, droughty, slope.
GuD*: Gilpin-----------	Slope, depth to rock, seepage.	Thin layer, piping.	No water-------	Deep to water	Slope, depth to rock.	Slope, depth to rock.
Orthents.						
JoA--------------- Johnsburg	Seepage, depth to rock.	Piping---------	No water-------	Percs slowly, frost action.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
MgA--------------- McGary	Favorable------	Wetness--------	Slow refill----	Percs slowly---	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
Mo---------------- Montgomery	Favorable------	Hard to pack, ponding.	Slow refill----	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
NeD3, NeF: Negley	Slope, seepage.	Seepage	No water	Deep to water	Slope	Slope.
NgC2: Negley	Slope, seepage.	Seepage	No water	Deep to water	Favorable	Slope.
NgD2: Negley	Slope, seepage.	Seepage	No water	Deep to water	Slope	Slope.
No: Nolin	Seepage	Favorable, piping.	No water	Deep to water	Erodes easily	Erodes easily.
OrD*. Orthents						
OtA: Otwell	Favorable	Thin layer	No water	Deep to water	Erodes easily, rooting depth.	Erodes easily, rooting depth.
OtB: Otwell	Slope	Thin layer	No water	Deep to water	Erodes easily, rooting depth.	Erodes easily, rooting depth.
OtC2: Otwell	Slope	Thin layer	No water	Deep to water	Slope, erodes easily, rooting depth.	Slope, erodes easily, rooting depth.
PaB: Parke	Seepage, slope.	Favorable	No water	Deep to water	Erodes easily	Erodes easily.
PaC2, PaD3: Parke	Slope	Favorable	No water	Deep to water	Slope, erodes easily.	Slope, erodes easily.
PeB: Pekin	Seepage, slope.	Piping, wetness.	Slow refill	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
PeC2: Pekin	Slope	Piping, wetness.	Slow refill	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Pg: Peoga	Favorable	Wetness	Slow refill	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Ph: Petrolia	Favorable	Wetness	Slow refill	Floods, frost action.	Favorable	Wetness.
PkA, PkB: Pike	Seepage	Favorable	No water	Deep to water	Favorable	Erodes easily.
PrB: Princeton	Seepage, slope.	Thin layer, piping.	No water	Deep to water	Soil blowing	Favorable.
PrC, PrF: Princeton	Seepage, slope.	Thin layer, piping.	No water	Deep to water	Slope, soil blowing.	Slope.
Sf: Steff	Seepage	Piping	Deep to water, slow refill.	Floods	Erodes easily, wetness.	Erodes easily.
St: Stendal	Seepage	Piping, wetness.	Slow refill	Floods, frost action.	Wetness, erodes easily.	Erodes easily, wetness.
TlA, TlB: Tilsit	Depth to rock	Piping	No water	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
WeC2, WeC3: Wellston	Slope	Piping	No water	Deep to water	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
ZnC2, ZnC3: Zanesville	Depth to rock, seepage.	Piping	No water	Percs slowly, slope.	Slope, rooting depth, wetness.	Erodes easily, slope, rooting depth.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AfB, AfC2, AfE2----- Alford	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	13-34	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	30-50	15-30
	34-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
Ba----------------- Bartle	0-17	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	5-15
	17-30	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	30-50	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	50-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
Bo----------------- Bonnie	0-12	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	12-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
Bu----------------- Burnside	0-12	Silt loam--------	ML, CL, CL-ML	A-4	0-10	100	100	80-95	75-95	20-35	2-10
	12-46	Channery loam, very channery loam.	SC, GC, SM, GM	A-2, A-4	10-60	35-80	30-60	30-50	26-45	<20	NP-10
	46	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ch----------------- Chagrin	0-10	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	70-90	20-35	2-10
	10-32	Silt loam, loam, sandy loam.	ML, SM	A-4	0	90-100	85-100	75-90	45-85	20-40	NP-10
	32-60	Stratified silt loam to fine sand.	ML, SM	A-4, A-2	0	85-100	80-100	55-85	30-80	20-40	NP-10
Cu----------------- Cuba	0-47	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	98-100	90-100	70-90	25-35	3-12
	47-66	Stratified silt loam to fine sand.	CL, ML, CL-ML	A-4	0	100	90-100	75-100	50-85	15-30	2-10
DuA, DuB----------- Dubois	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-95	25-35	5-15
	16-30	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-95	25-40	5-20
	30-58	Silty clay loam, loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	80-95	25-40	5-20
	58-80	Stratified silty clay to fine sand.	CL	A-6, A-7	0	100	95-100	85-100	70-95	35-50	15-25
GlD2, GlD3, GlE, GlE3--------------- Gilpin	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-21	Channery silt loam, channery clay loam, silty clay loam.	GM, ML, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	21-28	Channery loam, very channery silt loam, very shaly silty clay loam.	GM, GC, GM-GC	A-1, A-2, A-4	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
GoF*:											
Gilpin	0-6	Silt loam	ML, CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-21	Channery silt loam, channery clay loam, silty clay loam.	GM, ML, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	21-28	Channery loam, very channery silt loam, very shaly silty clay loam.	GM, GC, GM-GC	A-1, A-2, A-4	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Berks	0-8	Channery silt loam.	GM, ML, GC, SC	A-2, A-4	0-30	50-80	45-70	40-60	30-55	25-36	5-10
	8-29	Channery silt loam.	GM, GC, SM, SC	A-1, A-2, A-4	0-30	40-80	35-70	25-60	20-45	25-36	5-10
	29	Weathered bedrock.	---	---	---	---	---	---	---	---	---
GuD*:											
Gilpin	0-4	Silt loam	ML, CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	4-27	Channery silt loam, channery loam, silty clay loam.	GM, ML, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Orthents.											
JoA Johnsburg	0-11	Silt loam	CL, ML	A-4, A-6	0	100	100	90-100	70-95	30-40	5-15
	11-22	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	20-30
	22-62	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-95	60-85	20-35	5-15
	62	Weathered bedrock.	---	---	---	---	---	---	---	---	---
MgA McGary	0-10	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-15
	10-30	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	90-100	45-60	25-35
	30-60	Stratified silty clay to silt loam.	CL, CH	A-6, A-7	0	95-100	95-100	95-100	85-100	35-55	20-35
Mo Montgomery	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-100	40-50	20-30
	12-46	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	90-100	50-65	30-42
	46-60	Stratified clay to silty clay loam.	CL, CH	A-7	0	100	100	90-100	85-100	40-55	20-32
NeD3, NeF Negley	0-11	Loam	ML, CL-ML	A-4, A-6	0	85-100	80-95	70-90	55-85	25-40	4-12
	11-18	Loam, gravelly clay loam, gravelly sandy clay loam.	SM, SC, ML, CL	A-4, A-2, A-6, A-7	0-5	70-95	65-85	50-80	25-65	25-45	3-17
	18-72	Gravelly sandy clay loam, sandy clay loam, sandy clay.	SM, SM-SC, SC	A-2, A-4, A-7, A-6	0-5	60-95	65-85	35-80	25-50	20-50	5-24

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NeD3, NeF----------Negley	72-80	Fine sandy loam, gravelly sandy loam.	SP-SM, SM, SM-SC	A-2	0-5	65-90	60-85	30-60	10-35	15-35	NP-15
NgC2, NgD2---------Negley	0-7	Silt loam--------	ML, CL-ML	A-4, A-6	0	85-100	80-95	70-90	55-85	25-40	4-12
	7-18	Clay loam, gravelly sandy clay loam.	SM, SC, ML, CL	A-4, A-2, A-6, A-7	0-5	70-95	65-85	50-80	25-65	25-45	3-17
	18-72	Gravelly sandy clay loam, sandy clay loam, sandy clay.	SM, SM-SC, SC	A-2, A-4, A-7, A-6	0-5	60-95	65-85	35-80	25-50	20-50	5-24
	72-80	Sandy loam, gravelly sandy loam.	SP-SM, SM, SM-SC	A-2	0-5	65-90	60-85	30-60	10-35	15-35	NP-15
No-----------------Nolin	0-10	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	10-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
OrD*. Orthents											
OtA, OtB, OtC2-----Otwell	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-35	5-15
	9-23	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-20
	23-44	Silty clay loam, loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	35-50	20-30
	44-80	Stratified loam to silty clay.	CL	A-6, A-7	0	95-100	90-100	85-100	80-95	35-50	15-25
PaB, PaC2, PaD3----Parke	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	9-30	Silty clay loam	CL	A-6, A-7	0	95-100	95-100	90-100	80-100	25-45	10-25
	30-80	Sandy clay loam, loam.	SC	A-2, A-6	0-3	90-100	85-95	75-90	30-50	25-35	10-15
PeB, PeC2----------Pekin	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-35	5-15
	8-25	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	25-44	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	88-98	65-90	25-35	5-15
	44-70	Stratified fine sandy loam to silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-85	20-30	5-15
Pg-----------------Peoga	0-18	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-40	5-15
	18-54	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	20-30
	54-80	Stratified silty clay loam to sandy loam.	CL, ML	A-6, A-7	0	100	100	90-100	70-95	35-50	10-25
Ph-----------------Petrolia	0-11	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-100	30-45	12-20
	11-60	Silty clay loam, silt loam.	CL	A-6, A-7, A-4	0	100	95-100	80-100	60-100	20-45	8-20

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
PkA, PkB----------- Pike	0-10	Silt loam-------	CL	A-4, A-6	0	100	100	90-100	80-95	25-35	8-15
	10-35	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	80-90	30-45	10-25
	35-48	Silty clay loam, silt loam, sandy clay loam.	CL, SC	A-6, A-2-6	0	80-90	70-90	60-90	30-80	20-35	10-20
	48-80	Stratified sand to sandy clay loam.	CL-ML, ML, SM, SM-SC	A-4, A-2-4, A-1	0	70-90	65-85	35-70	15-65	<20	NP-5
PrB, PrC, PrF------ Princeton	0-23	Fine sandy loam, loam.	SM, SC, ML, CL	A-4, A-2-4	0	100	100	60-85	30-55	<25	NP-10
	23-49	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-6	0	100	100	70-90	35-70	25-35	10-15
	49-60	Stratified fine sand to silt.	SM, ML, CL-ML, SM-SC	A-2-4, A-4	0	100	100	65-90	20-55	<20	NP-5
Sf----------------- Steff	0-11	Silt loam-------	ML	A-4	0	95-100	90-100	80-100	55-95	<35	NP-10
	11-50	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	70-95	20-40	3-20
	50-70	Silt loam, gravelly loam, very fine sandy loam.	ML, CL-ML, SM, GM	A-4, A-2, A-1	0-10	50-100	40-100	35-95	20-90	<35	NP-10
St----------------- Stendal	0-10	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
	10-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
TlA, TlB----------- Tilsit	0-8	Silt loam-------	ML, CL, CL-ML	A-4	0	90-100	85-100	75-100	60-100	20-35	NP-10
	8-25	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	65-100	25-40	5-20
	25-46	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	90-100	85-100	75-100	65-100	25-45	5-25
	46-72	Silt loam, channery silty clay loam, channery loam.	CL, CH, CL-ML	A-4, A-6, A-7	0-30	70-100	65-85	60-85	55-80	25-60	5-35
	72	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WeC2, WeC3--------- Wellston	0-7	Silt loam-------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	7-32	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	32-43	Silt loam, loam, gravelly loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	43	Weathered bedrock.	---	---	---	---	---	---	---	---	---
ZnC2, ZnC3--------- Zanesville	0-9	Silt loam-------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	9-32	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	32-56	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	56-79	Silty clay, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	79	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
AfB, AfC2, AfE2-- Alford	0-13	0.6-2.0	0.22-0.24	3.6-7.3	Low	0.37	5	5
	13-34	0.6-2.0	0.18-0.20	3.6-6.0	Moderate	0.37		
	34-60	0.6-2.0	0.20-0.22	4.5-7.3	Low	0.37		
Ba-- Bartle	0-17	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	4	5
	17-30	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43		
	30-50	<0.06	0.06-0.08	4.5-5.5	Low	0.43		
	50-60	0.2-0.6	0.15-0.18	5.1-7.3	Low	0.43		
Bo-- Bonnie	0-12	0.6-2.0	0.22-0.24	6.6-7.3	Low	0.43	5	6
	12-60	0.06-2.0	0.20-0.22	4.5-5.5	Low	0.43		
Bu-- Burnside	0-12	0.6-2.0	0.22-0.24	4.5-6.0	Low	0.37	4	5
	12-46	0.6-2.0	0.10-0.16	4.5-5.5	Low	0.37		
	46	---	---	---	---	----		
Ch-- Chagrin	0-10	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.32	5	5
	10-32	0.6-2.0	0.14-0.20	5.6-7.3	Low	0.32		
	32-60	0.6-2.0	0.08-0.20	5.6-7.3	Low	0.32		
Cu-- Cuba	0-47	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.37	5	5
	47-66	0.6-2.0	0.19-0.21	4.5-5.0	Low	0.37		
DuA, DuB-- Dubois	0-16	0.2-0.6	0.22-0.24	4.5-7.3	Low	0.43	4	5
	16-30	0.2-0.6	0.18-0.20	4.5-5.5	Moderate	0.43		
	30-58	<0.06	0.06-0.08	4.5-5.5	Moderate	0.43		
	58-80	<0.06	0.06-0.08	4.5-7.3	Moderate	0.43		
GlD2, GlD3, GlE, GlE3-- Gilpin	0-6	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3	---
	6-21	0.6-2.0	0.10-0.16	3.6-5.5	Low	0.28		
	21-28	0.6-2.0	0.06-0.10	3.6-5.5	Low	0.28		
	28	---	---	---	---	----		
GoF*:								
Gilpin--	0-6	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3	---
	6-21	0.6-2.0	0.10-0.16	3.6-5.5	Low	0.28		
	21-28	0.6-2.0	0.06-0.10	3.6-5.5	Low	0.28		
	28	---	---	---	---	----		
Berks--	0-8	0.6-6.0	0.08-0.12	3.6-6.5	Low	0.24	3	---
	8-29	0.6-6.0	0.04-0.10	3.6-6.5	Low	0.17		
	29	---	---	---	---	----		
GuD*:								
Gilpin--	0-4	0.6-2.0	0.12-0.18	3.6-5.5	Low	0.32	3	---
	4-27	0.6-2.0	0.10-0.16	3.6-5.5	Low	0.28		
	27	---	---	---	---	----		
Orthents.								
JoA-- Johnsburg	0-11	0.6-2.0	0.20-0.24	4.5-6.5	Low	0.43	3	5
	11-22	0.6-2.0	0.18-0.22	3.6-5.5	Moderate	0.43		
	22-62	<0.06	0.06-0.08	3.6-5.5	Low	0.43		
	62	---	---	---	---	----		
MgA-- McGary	0-10	0.6-2.0	0.22-0.24	6.6-7.3	Low	0.43	3	5
	10-30	<0.2	0.11-0.13	5.6-7.8	High	0.32		
	30-60	<0.2	0.14-0.16	7.9-8.4	High	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
Mo---------------- Montgomery	0-12	0.2-0.6	0.20-0.23	6.1-7.8	High----------	0.37	5	7
	12-46	<0.2	0.11-0.18	6.1-7.8	High----------	0.37		
	46-60	<0.2	0.18-0.20	7.4-8.4	Moderate------	0.37		
NeD3, NeF, NgC2, NgD2----------- Negley	0-11	2.0-6.0	0.16-0.22	4.5-6.5	Low-----------	0.32	3	5
	11-18	0.6-6.0	0.09-0.16	4.5-6.0	Low-----------	0.32		
	18-72	0.6-6.0	0.06-0.14	4.5-6.0	Low-----------	0.32		
	72-80	6.0-20	0.06-0.10	5.1-7.3	Low-----------	0.32		
No---------------- Nolin	0-10	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43	5	---
	10-60	0.6-2.0	0.18-0.23	5.6-8.4	Low-----------	0.43		
OrD*. Orthents								
OtA, OtB, OtC2--- Otwell	0-9	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	3	5
	9-23	0.06-0.2	0.18-0.22	5.1-5.5	Low-----------	0.43		
	23-44	<0.06	0.06-0.08	4.5-5.5	Moderate------	0.43		
	44-80	0.06-0.2	0.19-0.21	5.1-5.5	Moderate------	0.43		
PaB, PaC2, PaD3-- Parke	0-9	0.6-2.0	0.22-0.24	5.1-6.5	Low-----------	0.37	5-4	5
	9-30	0.6-2.0	0.18-0.20	4.5-5.0	Moderate------	0.37		
	30-80	0.6-2.0	0.16-0.18	4.5-5.5	Low-----------	0.28		
PeB, PeC2-------- Pekin	0-8	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.43	4	5
	8-25	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43		
	25-44	<0.06	0.06-0.08	4.5-6.0	Low-----------	0.43		
	44-80	0.6-2.0	0.06-0.08	5.6-7.3	Low-----------	0.43		
Pg---------------- Peoga	0-18	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	4	5
	18-54	0.06-0.2	0.18-0.20	4.5-5.5	Moderate------	0.43		
	54-80	0.06-0.2	0.19-0.21	4.5-6.5	Low-----------	0.43		
Ph---------------- Petrolia	0-11	0.2-0.6	0.21-0.23	5.6-6.0	Moderate------	0.32	4	7
	11-60	0.2-0.6	0.18-0.20	6.1-7.8	Moderate------	0.32		
PkA, PkB--------- Pike	0-10	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5-4	5
	10-35	0.6-2.0	0.18-0.22	4.5-5.5	Low-----------	0.37		
	35-48	0.6-2.0	0.12-0.18	4.5-5.5	Low-----------	0.37		
	48-80	2.0-6.0	0.05-0.12	4.5-8.4	Low-----------	0.37		
PrB, PrC, PrF---- Princeton	0-23	0.6-2.0	0.13-0.18	5.6-7.3	Low-----------	0.24	5-4	3
	23-49	0.6-2.0	0.16-0.18	5.1-6.5	Low-----------	0.32		
	49-60	2.0-6.0	0.06-0.08	6.1-8.4	Low-----------	0.17		
Sf---------------- Steff	0-11	0.6-2.0	0.15-0.23	4.5-7.3	Low-----------	0.43	5	---
	11-50	0.6-2.0	0.18-0.23	4.5-5.5	Low-----------	0.43		
	50-70	0.6-6.0	0.08-0.21	4.5-5.5	Low-----------	0.43		
St---------------- Stendal	0-10	0.6-2.0	0.22-0.24	4.5-6.5	Low-----------	0.37	5	5
	10-60	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.37		
TlA, TlB--------- Tilsit	0-8	0.6-2.0	0.16-0.22	3.6-5.5	Low-----------	0.43	3	---
	8-25	0.6-2.0	0.16-0.22	3.6-5.5	Low-----------	0.43		
	25-46	0.06-0.2	0.08-0.12	3.6-5.5	Low-----------	0.43		
	46-72	0.06-0.6	0.08-0.12	3.6-5.5	Low-----------	0.43		
	72	---	---	---	--------------	----		
WeC2, WeC3------- Wellston	0-7	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6
	7-32	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37		
	32-43	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.37		
	43	---	---	---	--------------	----		
ZnC2, ZnC3------- Zanesville	0-9	0.6-2.0	0.19-0.23	4.5-5.5	Low-----------	0.37	3	---
	9-32	0.6-2.0	0.17-0.22	4.5-5.5	Low-----------	0.37		
	32-56	0.06-0.6	0.08-0.12	4.5-5.5	Low-----------	0.37		
	56-79	0.2-2.0	0.08-0.12	4.5-5.5	Low-----------	0.28		
	79	---	---	---	--------------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AfB, AfC2, AfE2: Alford	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	High.
Ba: Bartle	D	None	---	---	1.0-2.0	Perched	Jan-Apr	>60	---	High	High	High.
Bo: Bonnie	C/D	Frequent	Long	Mar-Jun	0-1.0	Apparent	Mar-Jun	>60	---	High	High	High.
Bu: Burnside	B	Occasional	Brief	Mar-Jun	3.0-5.0	Apparent	Feb-Jun	29-65	Hard	Moderate	Low	High.
Ch: Chagrin	B	Frequent	Brief	Nov-May	4.0-6.0	Apparent	Feb-Mar	>60	---	Moderate	Low	Moderate.
Cu: Cuba	B	Occasional	Brief	Jan-May	>6.0	---	---	>60	---	High	Low	High.
DuA, DuB: Dubois	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	High.
GlD2, GlD3, GlE, GlE3: Gilpin	C	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low	High.
GoF*:												
Gilpin	C	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low	High.
Berks	C	None	---	---	>6.0	---	---	20-40	Rippable	Low	Low	High.
GuD*:												
Gilpin	C	None	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low	High.
Orthents.												
JoA: Johnsburg	D	None	---	---	1.0-3.0	Perched	Jan-Apr	48-72	Rippable	High	High	High.
MgA: McGary	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	Moderate	High	Low.
Mo**: Montgomery	D	None	---	---	+.1-1.0	Apparent	Dec-May	>60	---	Moderate	High	Low.
NeD3, NeF, NgC2, NgD2: Negley	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
No: Nolin	B	Frequent	Brief to long.	Feb-May	3.0-6.0	Apparent	Feb-Mar	>60	---	---	Low	Moderate.

See footnotes at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
OrD*. Orthents												
OtA, OtB, OtC2----- Otwell	C	None---------	---	---	3.5-6.0	Perched	Jan-Apr	>60	---	High-----	Moderate	High.
PaB, PaC2, PaD3--- Parke	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.
PeB, PeC2---------- Pekin	C	Rare---------	---	---	2.0-6.0	Apparent	Mar-Apr	>60	---	High-----	Moderate	High.
Pg----------------- Peoga	C	None---------	---	---	0.-1.0	Apparent	Jan-May	>60	---	High-----	High-----	High.
Ph----------------- Petrolia	B/D	Frequent----	Long------	Mar-Jun	0-3.0	Apparent	Apr-Jun	>60	---	High-----	High-----	Low.
PkA, PkB----------- Pike	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	High.
PrB, PrC, PrF------ Princeton	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Sf----------------- Steff	C	Frequent----	Brief-----	Dec-Apr	1.5-3.0	Apparent	Dec-Apr	>60	---	High-----	Moderate	High.
St----------------- Stendal	C	Frequent----	Brief-----	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	High.
TlA, TlB----------- Tilsit	C	None---------	---	---	1.5-2.5	Perched	Jan-Apr	>40	Hard	---	High-----	High.
WeC2, WeC3--------- Wellston	B	None---------	---	---	>6.0	---	---	>40	Hard	High-----	Moderate	High.
ZnC2, ZnC3--------- Zanesville	C	None---------	---	---	2.0-3.0	Perched	Dec-Apr	40-80	Hard	---	Moderate	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

** A plus sign under "Depth to high water table" indicates that the water table is above the surface of the soil.

TABLE 18.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
*Alford	Fine-silty, mixed, mesic Typic Hapludalfs
Bartle	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Berks	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Bonnie	Fine-silty, mixed, acid, mesic Typic Fluvaquents
Burnside	Loamy-skeletal, mixed, acid, mesic Typic Udifluvents
Chagrin	Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Cuba	Fine-silty, mixed, mesic Fluventic Dystrochrepts
Dubois	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Johnsburg	Fine-silty, mixed, mesic Aquic Fragiudults
McGary	Fine, mixed, mesic Aeric Ochraqualfs
Montgomery	Fine, mixed, mesic Typic Haplaquolls
Negley	Fine-loamy, mixed, mesic Typic Paleudalfs
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Orthents	Loamy, mixed, mesic Typic Udorthents
Otwell	Fine-silty, mixed, mesic Typic Fragiudalfs
Parke	Fine-silty, mixed, mesic Ultic Hapludalfs
Pekin	Fine-silty, mixed, mesic Aquic Fragiudalfs
Peoga	Fine-silty, mixed, mesic Typic Ochraqualfs
Petrolia	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Pike	Fine-silty, mixed, mesic Ultic Hapludalfs
Princeton	Fine-loamy, mixed, mesic Typic Hapludalfs
Steff	Fine-silty, mixed, mesic Fluvaquentic Dystrochrepts
Stendal	Fine-silty, mixed, acid, mesic Aeric Fluvaquents
Tilsit	Fine-silty, mixed, mesic Typic Fragiudults
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs

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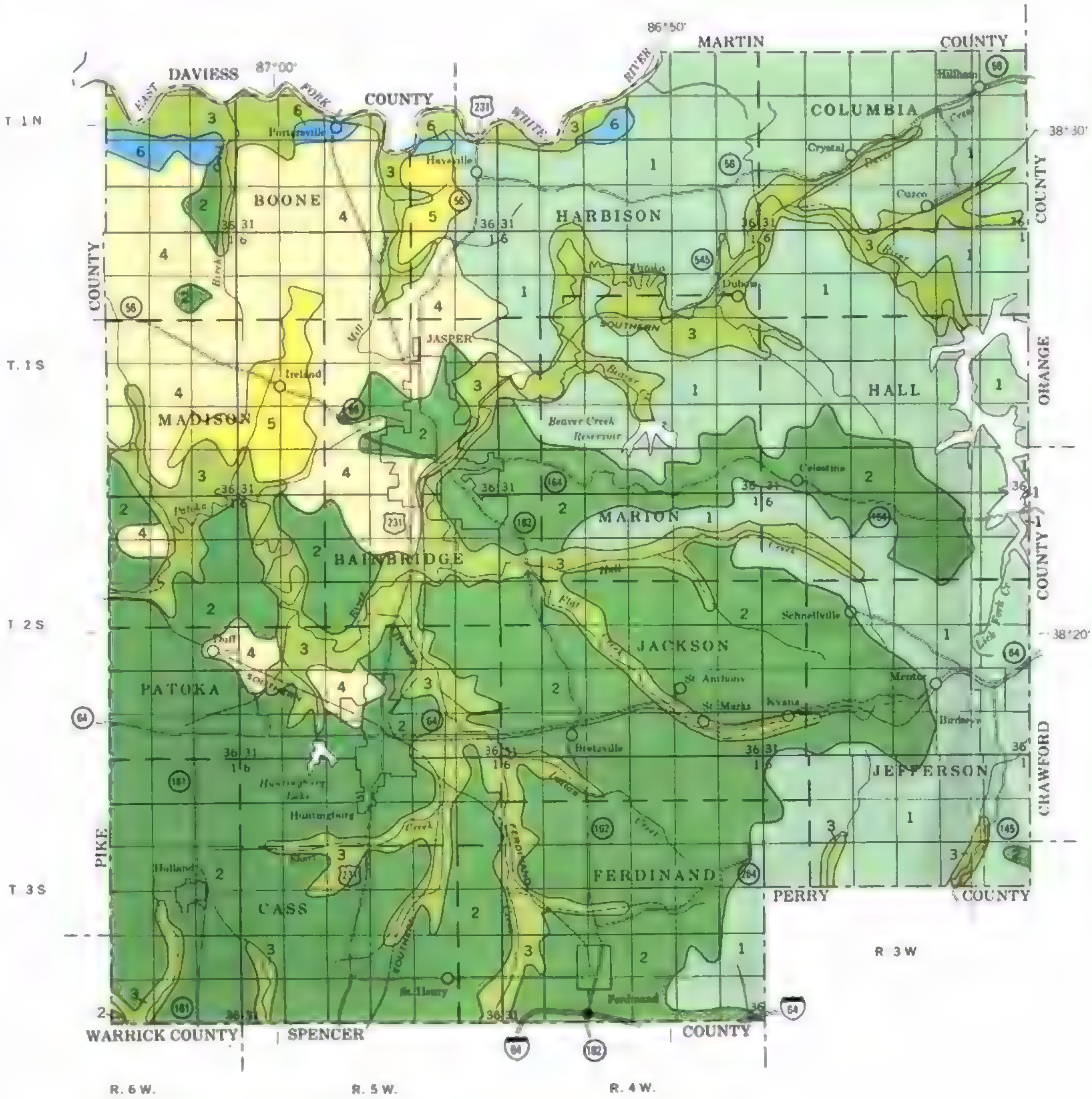
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION
INDIANA DEPARTMENT OF NATURAL RESOURCES, SOIL AND WATER CONSERVATION COMITTEE

GENERAL SOIL MAP

DUBOIS COUNTY, INDIANA

Scale 1: 190,080



SOIL LEGEND

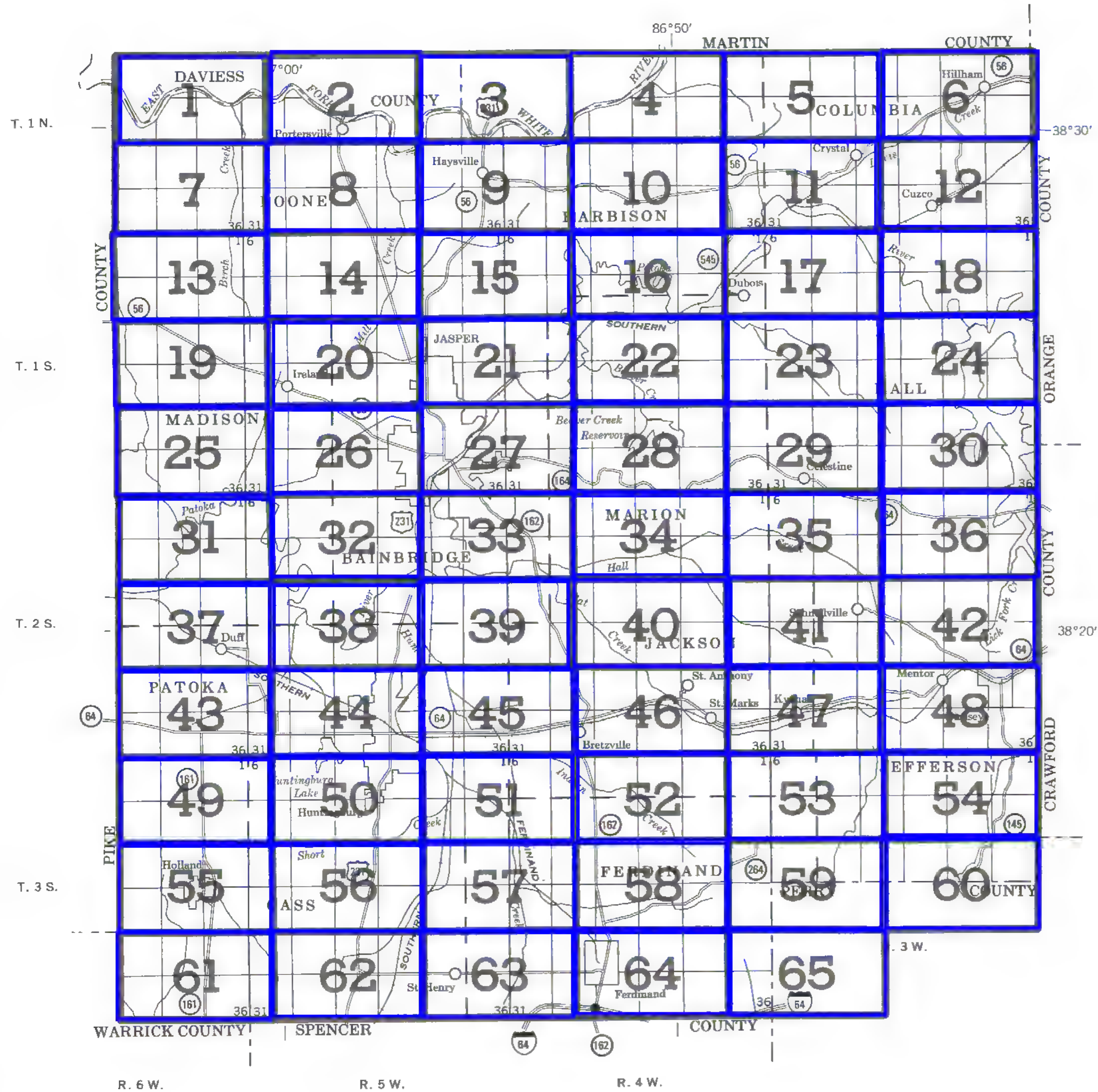
1	Gilpin–Zanesville–Berks: Moderately deep and deep, moderately sloping to very steep, well drained soils; on uplands
2	Zanesville–Gilpin–Tilsit: Deep and moderately deep, nearly level to moderately steep, well drained and moderately well drained soils; on uplands
3	Stendal–Steff–Cuba: Deep, nearly level, somewhat poorly drained to well drained soils; on flood plains
4	Otwell–Dubois–Peoga: Deep, nearly level to moderately sloping, well drained to poorly drained soils; on lake plains and terraces
5	Pike–Negley–Parke: Deep, nearly level to very steep, well drained soils; on lake plains and outwash terraces
6	Alford–Princeton: Deep, gently sloping to very steep, well drained soils; on uplands

Compiled 1979

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

DUBOIS COUNTY, INDIANA

Scale 1: 190,080

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — CeA FeB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Sanitary land fill area up to 10 acres in size
- Muck spot up to 3 acres in size

SOIL LEGEND

Map symbols consist of two or three letters or of letters and a final number; as an example, Ba, DuB, and NgC2. The first letter is a capital and it is the first letter of the soil name. The second letter is lowercase and it is used to separate mapping units that begin with the same letter. The third letter is a capital and it indicates the class of slope. Symbols without a slope letter are for mapping units that do not have slope as part of the name and that are level or nearly level. A final number of 2 or 3 indicates the degree of erosion.

SYMBOL	NAME
AfB	Alford silt loam, 2 to 6 percent slopes
AfC2	Alford silt loam, 6 to 12 percent slopes, eroded
AfE2	Alford silt loam, 15 to 25 percent slopes, eroded
Ba	Bartle silt loam
Bo	Bonnie silt loam
Bu	Burnside silt loam
Ch	Chagrin silt loam
Cu	Cuba silt loam
DuA	Dubois silt loam, 0 to 2 percent slopes
DuB	Dubois silt loam, 2 to 6 percent slopes
GlD2	Gilpin silt loam, 12 to 18 percent slopes, eroded
GlD3	Gilpin silt loam, 12 to 18 percent slopes, severely eroded
GlE	Gilpin silt loam, 18 to 25 percent slopes
GlE3	Gilpin silt loam, 18 to 25 percent slopes, severely eroded
GoF	Gilpin—Berks complex, 20 to 50 percent slopes
GuD	Gilpin—Orthents complex, 12 to 25 percent slopes
JoA	Johnsburg silt loam, 0 to 2 percent slopes
MgA	McGary silt loam, 0 to 2 percent slopes
Mo	Montgomery silty clay loam
NeD3	Negley loam, 12 to 18 percent slopes, severely eroded
NeF	Negley loam, 18 to 50 percent slopes
NgC2	Negley silt loam, 6 to 12 percent slopes, eroded
NgD2	Negley silt loam, 12 to 18 percent slopes, eroded
No	Nolin silt loam
OrD	Orthents, 6 to 25 percent slopes
OtA	Otwell silt loam, 0 to 2 percent slopes
OtB	Otwell silt loam, 2 to 6 percent slopes
OtC2	Otwell silt loam, 6 to 12 percent slopes, eroded
PaB	Parke silt loam, 2 to 6 percent slopes
PaC2	Parke silt loam, 6 to 12 percent slopes, eroded
PaD3	Parke silt loam, 12 to 18 percent slopes, severely eroded
PeB	Pekin silt loam, 2 to 6 percent slopes
PeC2	Pekin silt loam, 6 to 12 percent slopes, eroded
Pg	Peoga silt loam
Ph	Petrolia silty clay loam
PkA	Pike silt loam, 0 to 2 percent slopes
PkB	Pike silt loam, 2 to 6 percent slopes
PrB	Princeton fine sandy loam, 2 to 6 percent slopes
PrC	Princeton fine sandy loam, 6 to 12 percent slopes
PrF	Princeton fine sandy loam, 20 to 60 percent slopes
Sf	Steff silt loam
St	Stendal silt loam
TlA	Tilsit silt loam, 0 to 2 percent slopes
TlB	Tilsit silt loam, 2 to 6 percent slopes
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded
WeC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded
ZnC2	Zanesville silt loam, 6 to 12 percent slopes, eroded
ZnC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded

DUBOIS COUNTY, INDIANA NO. 1

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(2)

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DUBOIS COUNTY, INDIANA NO.

DUBOIS COUNTY, INDIANA NO. 3

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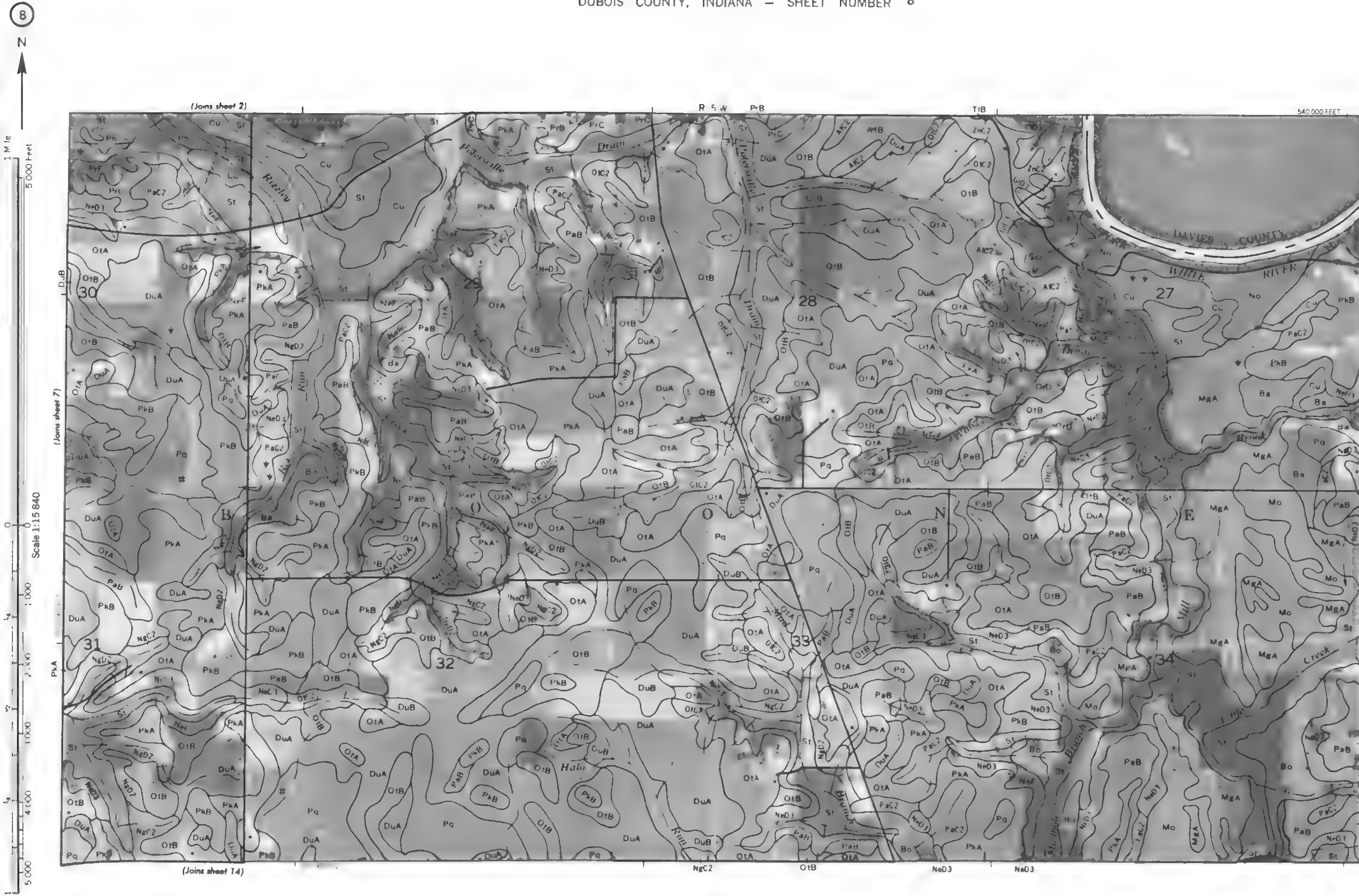
4


N
MARTIN COUNTY
R 4 W
T 1 N
(Joins sheet 5)
(Joins sheet 10)
Scale 1:15 840
MARTIN COUNTY
EAST
FORK
WHITE
RIVER
Creek
H A R B I S O N
20
21
22
23
14
15

DUBOIS COUNTY, INDIANA NO. 5


6
N
1 Mile
5 000 Feet
Scale 1:15 840
MARTIN COUNTY
R 3 W
T 1 N
ORANGE COUNTY
(Joins sheet 5)
(Joins sheet 12)
HOOSIER NATIONAL FOREST
Hillham
Davis Creek
13
14
15
16
21
22
23
24

DUBOIS COUNTY, INDIANA NO. 7



DUBOIS COUNTY, INDIANA NO. 8

9

DUBOIS COUNTY, INDIANA NO. 9

This map is compiled on [illegible] aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


10
N
(Joins sheet 4)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 16)
R. 4 W.
575 000 FEET
560 000 FEET
Kellerville
Scale 1:15 840
5 000 Feet
26
27
28
29
32
33
34
35

DUBOIS COUNTY, INDIANA NO. 11

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


12
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 6)
(Joins sheet 11)
(Joins sheet 18)
R 3 W
T. 1 N.
ORANGE COUNTY
HOOSIER
NATIONAL
FOREST
Cuzco
Dillon Creek
600 000 FEET
360 000 FEET
28
27
26
25
33
34
35
36

DUBOIS COUNTY, INDIANA NO. 13

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies

DUBOIS COUNTY, INDIANA NO. 14

DUBOIS COUNTY, INDIANA NO. 15

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

16

N

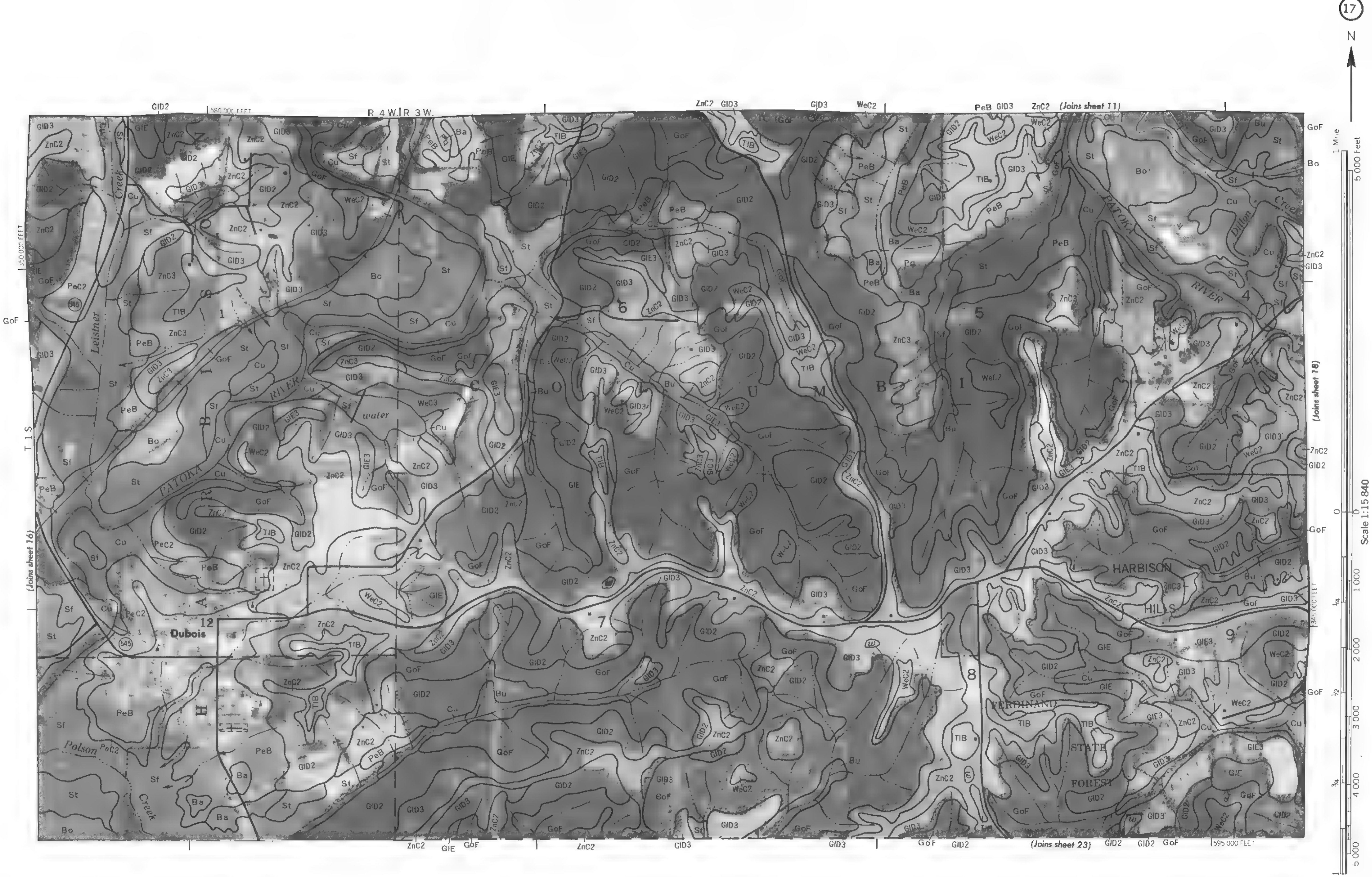
1 Mile

5 000 Feet

Scale 1:15 840

0 — 1 000 — ¼ — 2 000 — ½ — 3 000 — ¾ — 4 000 — 5 000 — 1

DUBOIS COUNTY, INDIANA NO. 16

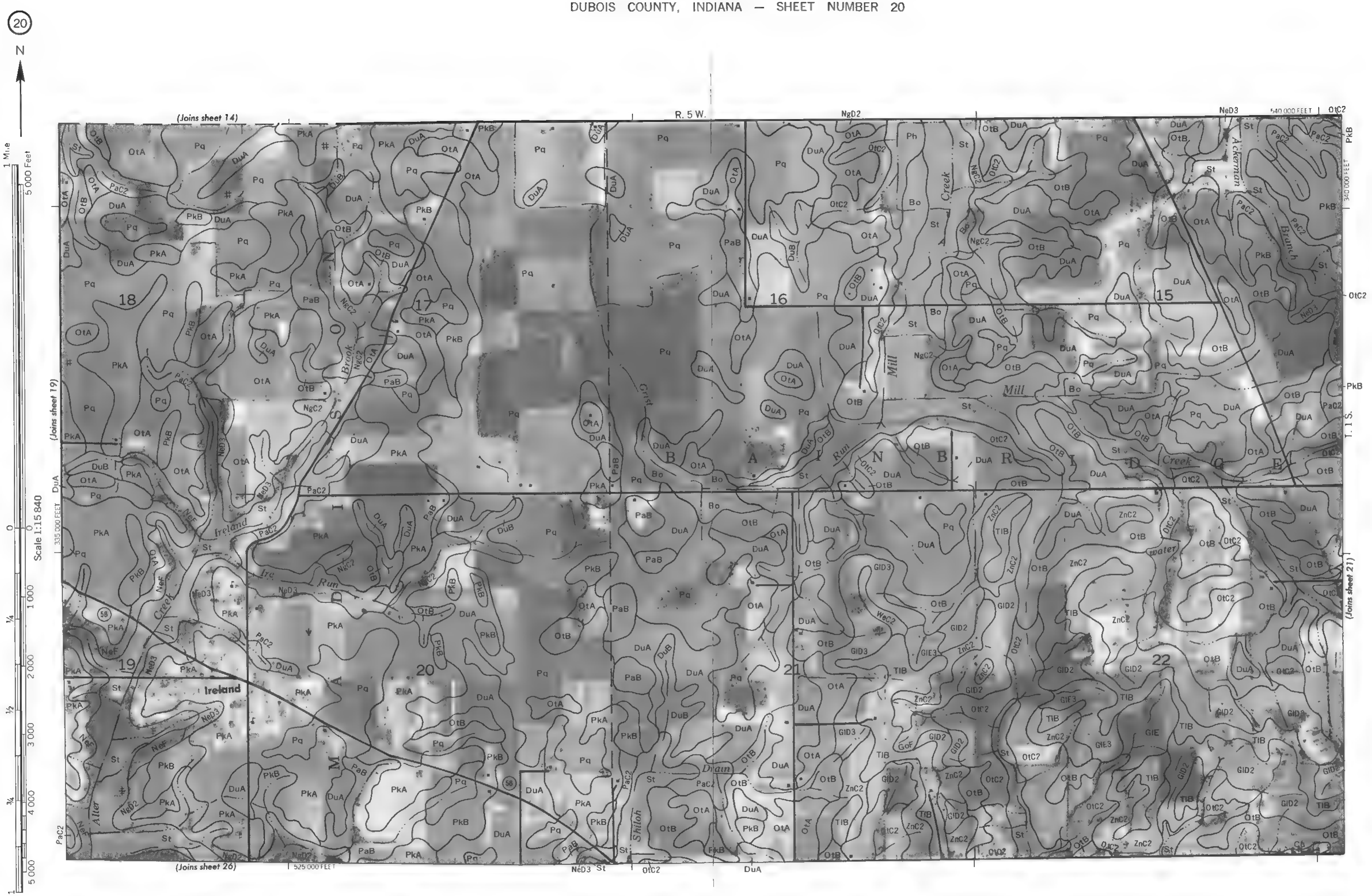


DUBOIS COUNTY, INDIANA NO. 17


18
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 24)
R. 3 W.
ORANGE COUNTY
T. 1 S.
350 000 FEET
345 000 FEET
600 000 FEET
HOOSIER
NATIONAL
FOREST
C O L U M B I A
PATOKA RIVER
PATOKA RESERVOIR
Lost
Ridge
water

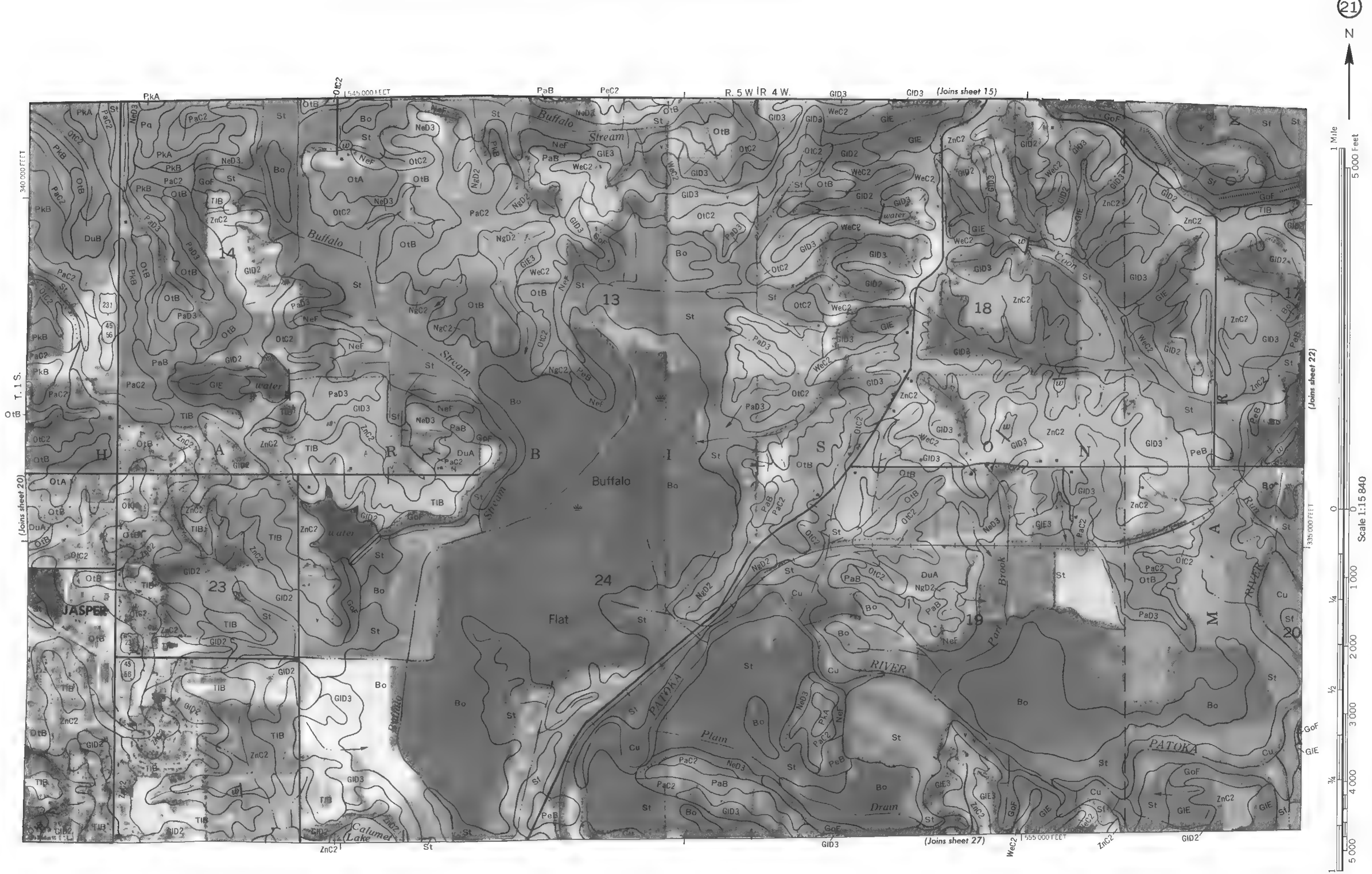
DUBOIS COUNTY, INDIANA NO. 19

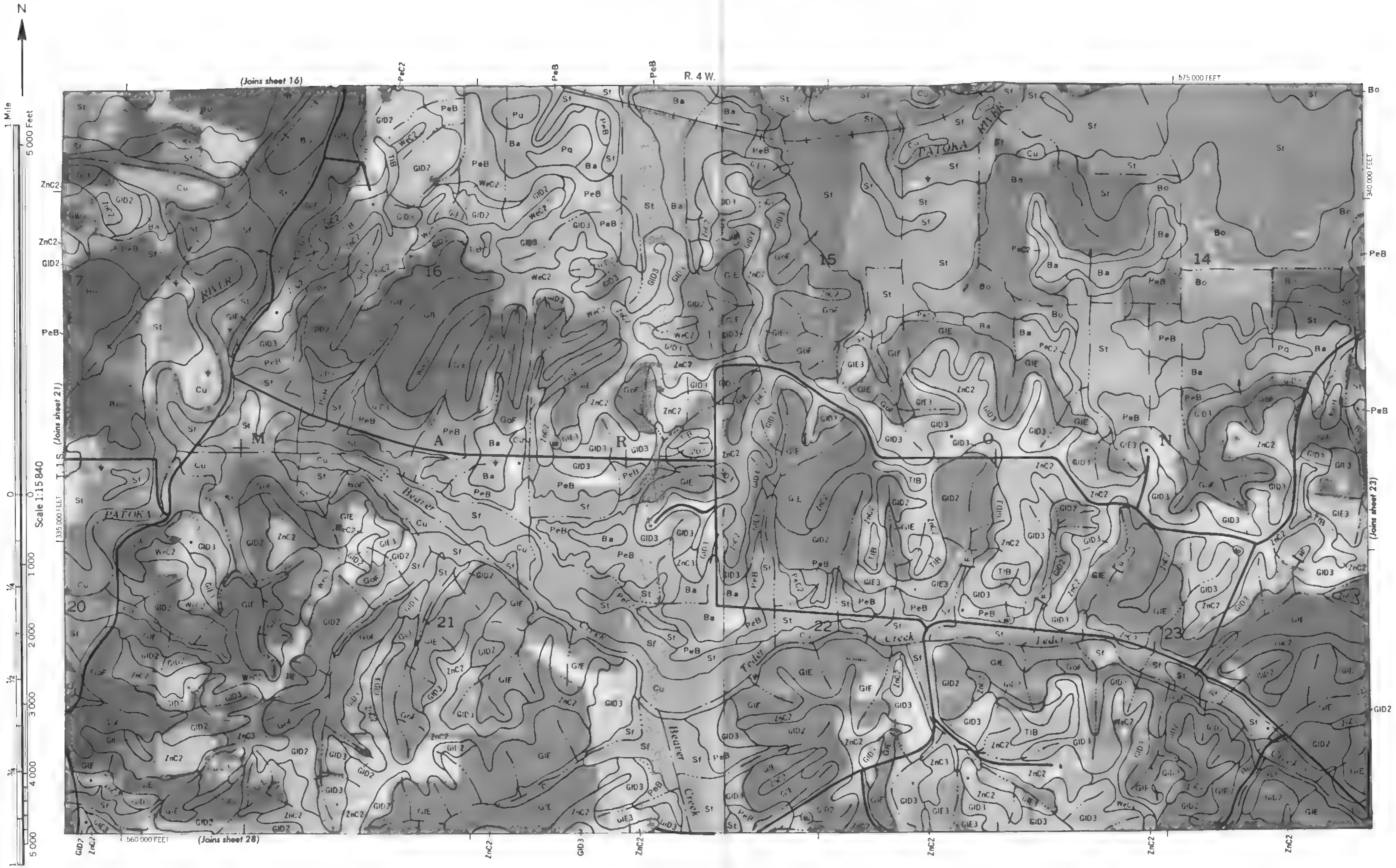
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 197? aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DUBOIS COUNTY, INDIANA NO. 21





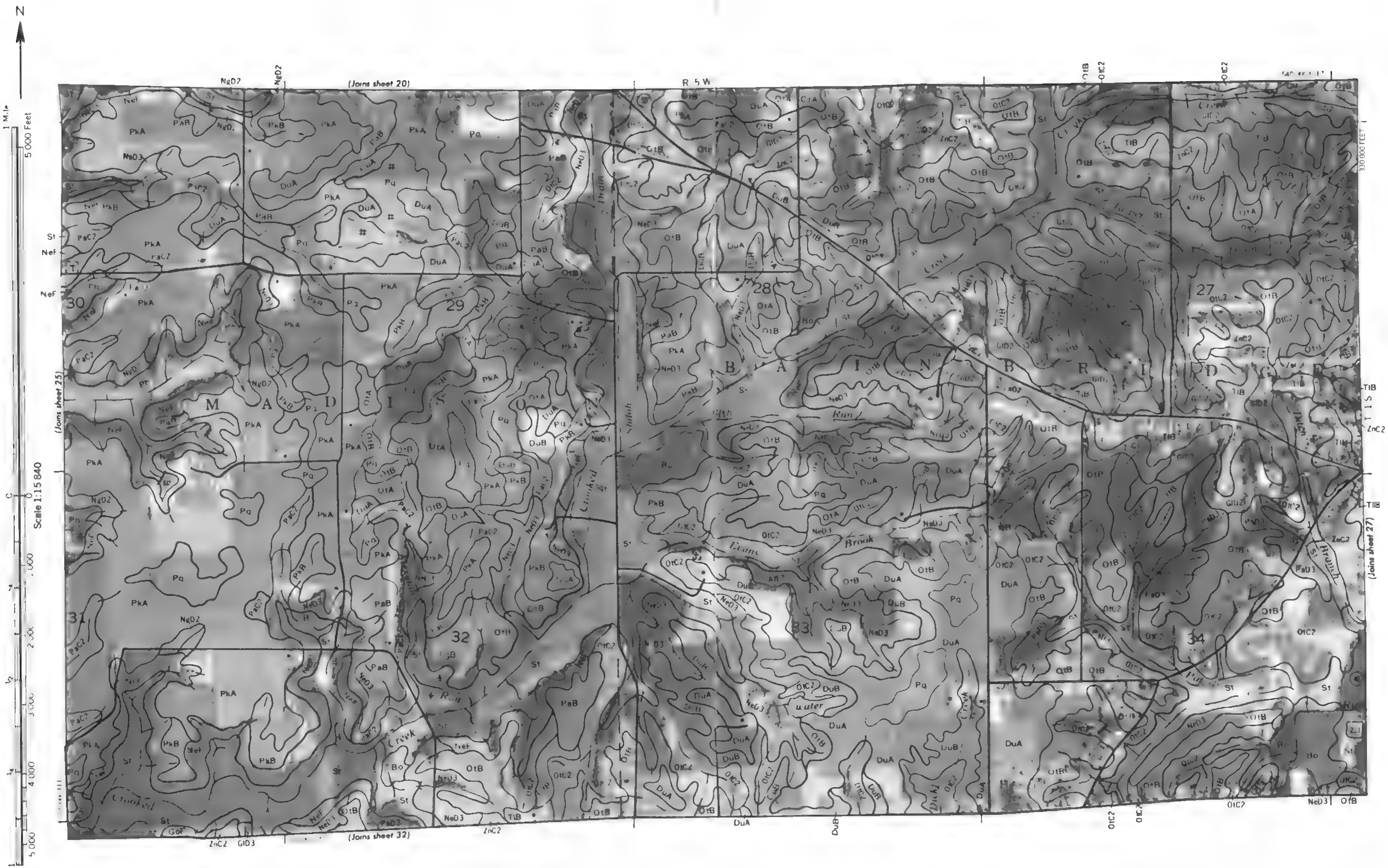
DUBOIS COUNTY, INDIANA NO. 22


23
N
(Joins sheet 17)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 29)
R. 4 W. | R. 3 W.
T. 1 S.
580 000 FEET
595 000 FEET
340 000 FEET
335 000 FEET
M A R I O N
H A L L
Polson
Bauer
Creek
Bailey
Pinnick
Creek
Scale 1:15 840
1 Mile
5 000 Feet
DUBOIS COUNTY, INDIANA NO. 23
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

DUBOIS COUNTY, INDIANA NO. 24

DUBOIS COUNTY, INDIANA NO. 25

DUBOIS COUNTY, INDIANA — SHEET NUMBER 26



DUBOIS COUNTY, INDIANA NO. 27

This map is compiled on 1965 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

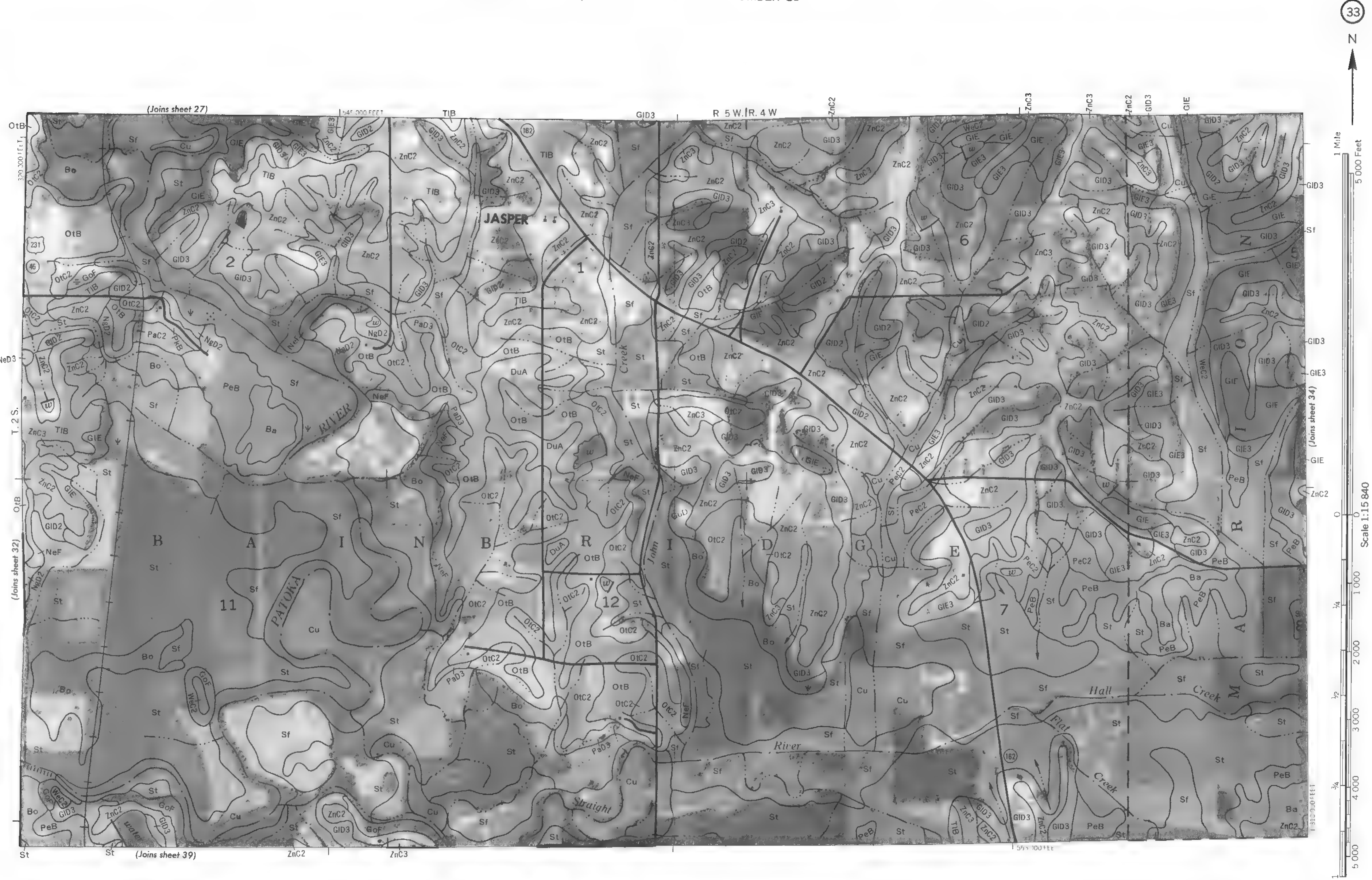

28
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 22)
R 4 W
(Joins sheet 27)
T 1 S
(Joins sheet 29)
(Joins sheet 34)
Creek
Reservoir
Beaver
M
A
R
I
O
N
26
27
28
29
32
33
34
35

DUBOIS COUNTY, INDIANA NO. 29

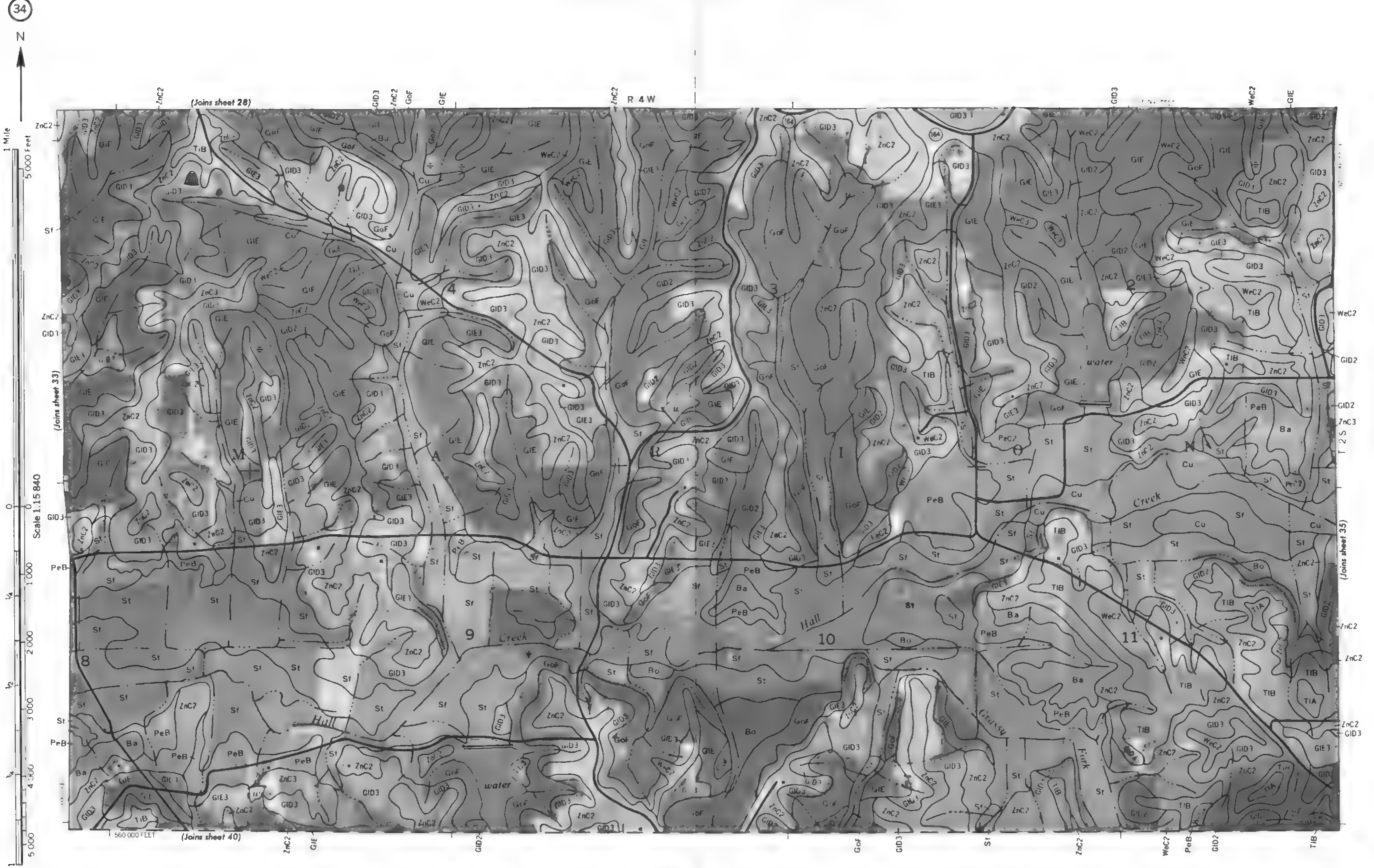

N
(Joins sheet 24)
(Joins sheet 29)
(Joins sheet 36)
R 3 W
T 1 S.
ORANGE COUNTY
CRAWFORD COUNTY
PATOKA
RESERVOIR
PATOKA
RESERVOIR
PATOKA
RESERVOIR
HOOSIER
NATIONAL
FOREST
615 000 FEET
600 000 FEET
325 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
28
27
26
25
33
34
35
36


(Joins sheet 25)
R. 6 W.
R. 5 W.
(Joins sheet 32)
(Joins sheet 37)
PIKE
COUNTY
T. 2 S.
M A D I S O N
PATOKA
RIVER
Flat
Creek
N
1 Mile
5 000 Feet
Scale 1:15 840


32
N
GoF (Joins sheet 26)
R 5 W
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 38)
T. 2 S.
320 000 FEET
Scale 1:15 840
1 Mile
5 000 Feet
PATOKA RIVER
Devils Backbone
MADISON
BRIDGE



DUBOIS COUNTY, INDIANA NO. 33

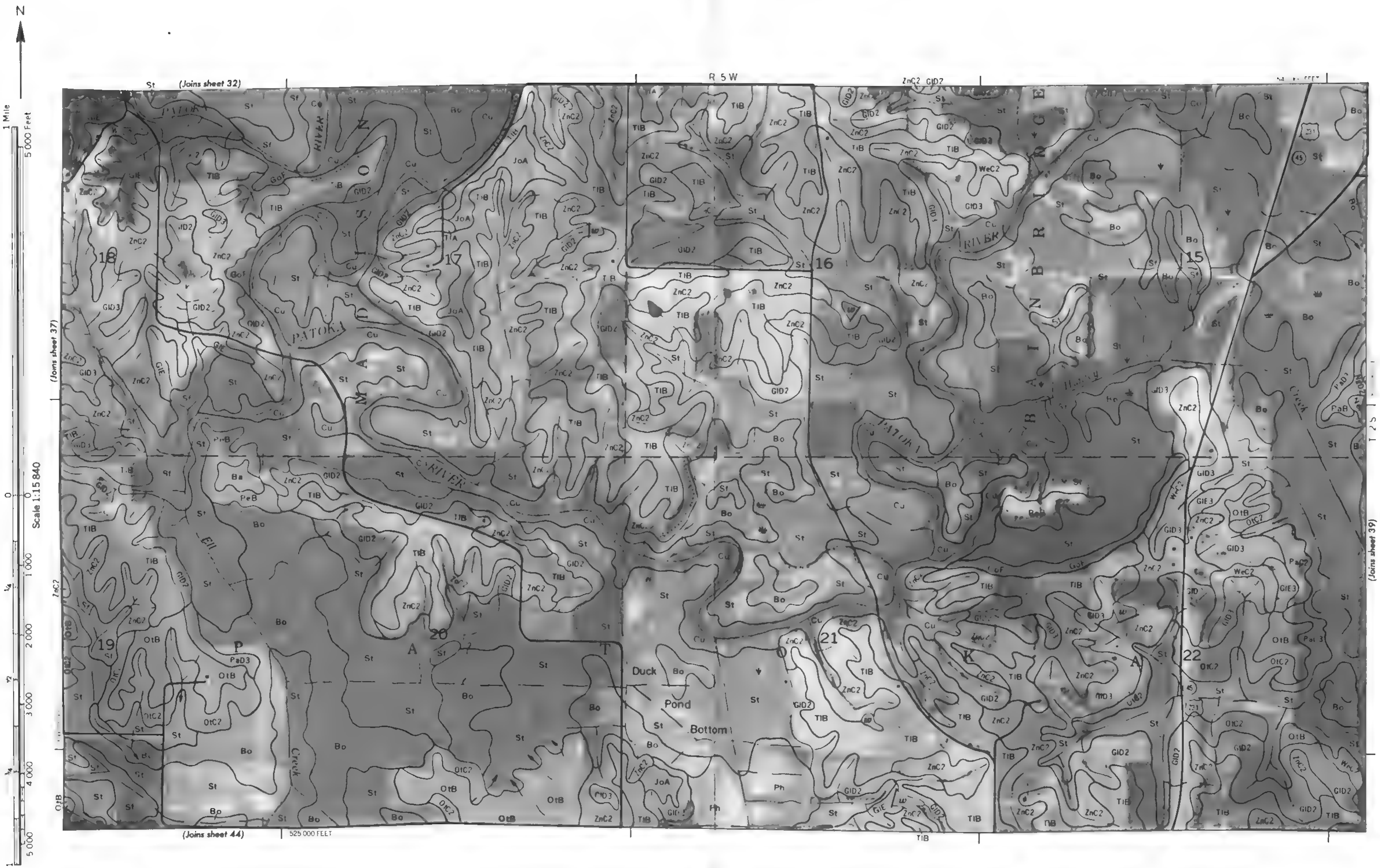

34
N
1 Mile
5000 Feet
Scale 1:15 840
(Joins sheet 28)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 40)
R 4 W
T 2 S
560 000 FEET
Hall Creek
Grassy Fork
water

DUBOIS COUNTY, INDIANA NO. 35

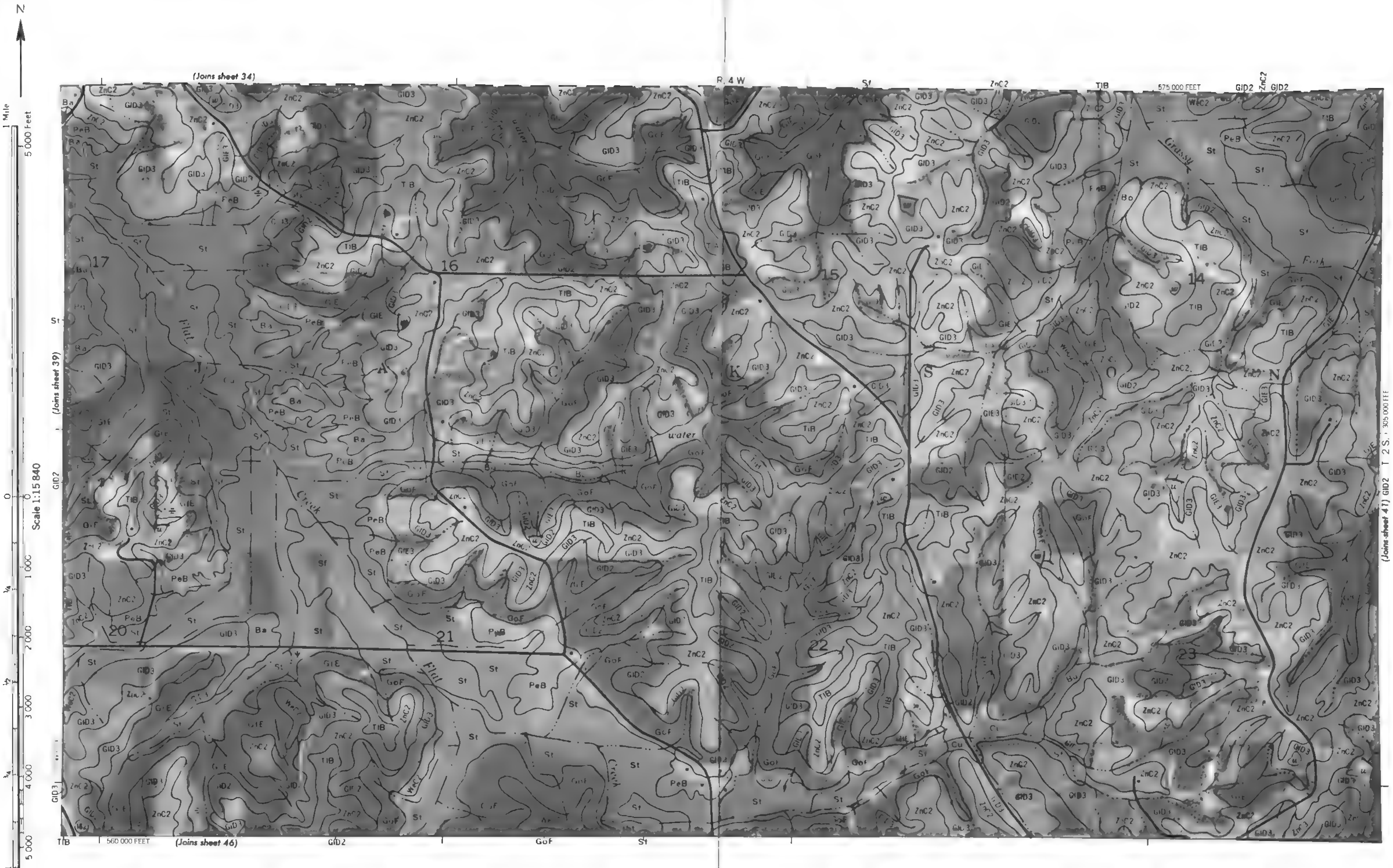
This map is compiled on 19.. aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


36
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 30)
R 3 W
(Joins sheet 35)
(Joins sheet 42)
PATOKA
RESERVOIR
PATOKA RESERVOIR PURCHASE AREA
T 2 S
CRAWFORD COUNTY
320 000 FEET


37
N
(Joins sheet 31)
R. 6 W. | R. 5 W.
505 000 FEET
PATOKA
RIVER
Millersport
Duff
(Joins sheet 38)
(Joins sheet 43)
520 000 FEET
305 000 FEET
300 000 FEET
T. 2 S.
PIKE
COUNTY
M A D I S O N
P A T O K A
14
13
15
18
22
23
24
19
Scale 1:15 840
1 Mile
5 000 Feet
DUBOIS COUNTY, INDIANA NO. 37


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 32)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 44)
R 5 W
525 000 FEET
PATOKA RIVER
MADISON
PATOKA
JAINBRIDGE
Duck Pond Bottom
Ell Creek
Hunley Creek
18
17
16
15
19
20
21
22

DUBOIS COUNTY, INDIANA NO. 39


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 34)
R. 4 W.
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 46)
575 000 FEET
560 000 FEET
305 000 FEET
T. 2 S.
17
16
15
14
20
21
22
23
Flat
Creek
Grassy
Fork
water

41


580 000 FEET
R. 4 W. | R. 3 W.
(Joins sheet 35)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 47)
T. 2 S.
305 000 FEET
300 000 FEET
595 000 FEET
Schnellville
Grassy
Fork
Creek
13
18
17
16
24
19
20
21
N
1 Mile
5 000 Feet
Scale 1:15 840


42
N
(Joins sheet 36)
(Joins sheet 41)
(Joins sheet 48)
R 3 W
615 000 FEET
600 000 FEET
5 000 Feet
Scale 1:15 840
J E F F E R S O N
16
15
14
13
21
22
23
24
CRAWFORD COUNTY
HOOSIER NATIONAL FOREST

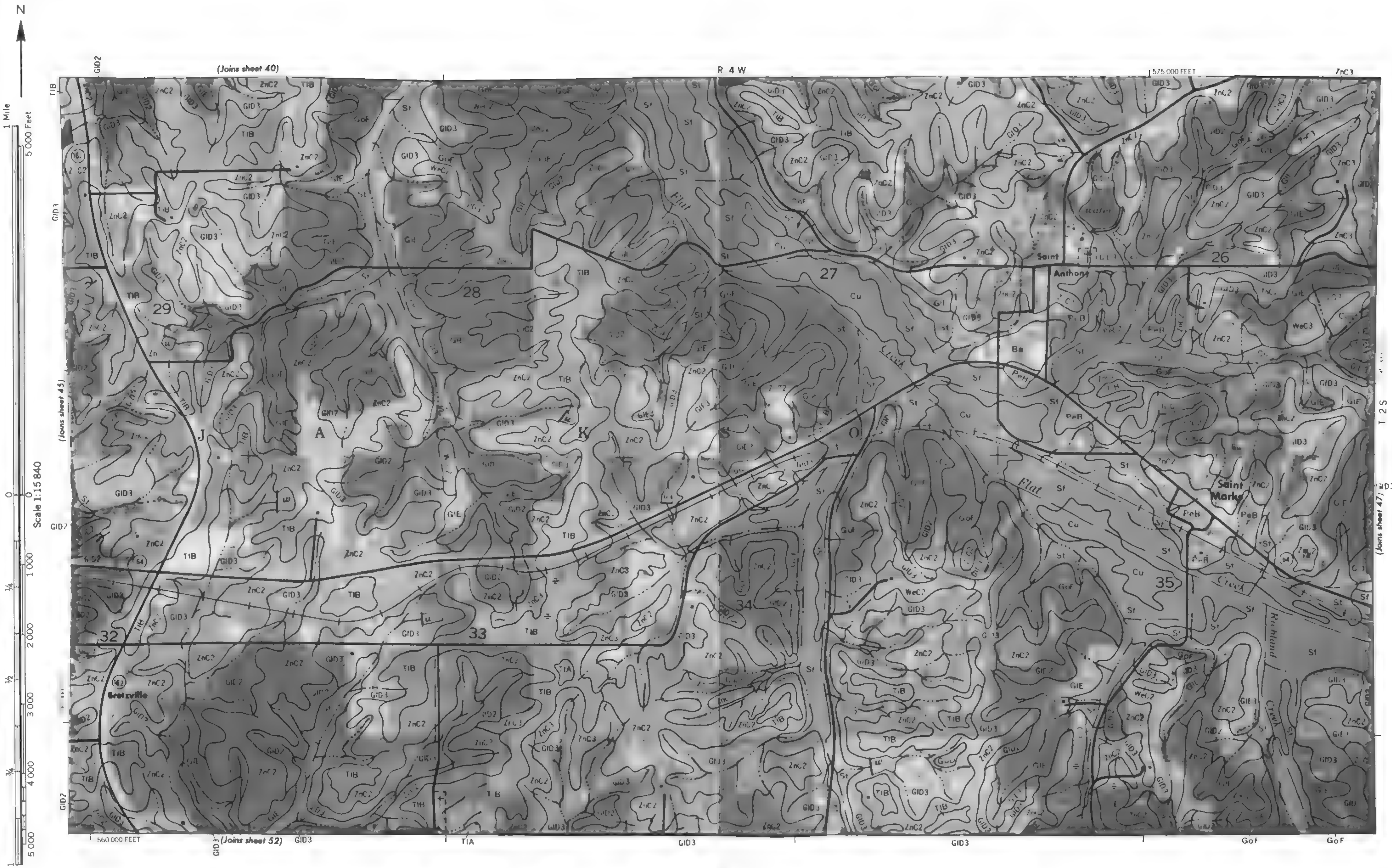
DUBOIS COUNTY, INDIANA NO. 43

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


44
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 38)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 50)
R 5 W
T 2 S
525 000 FEET
295 000 FEET
Huntingburg Lake
HUNTINGBURG
SEWAGE LAGOON
P A T O K A
27
28
29
30
31
32
33
34
water
Creek

DUBOIS COUNTY, INDIANA NO. 45

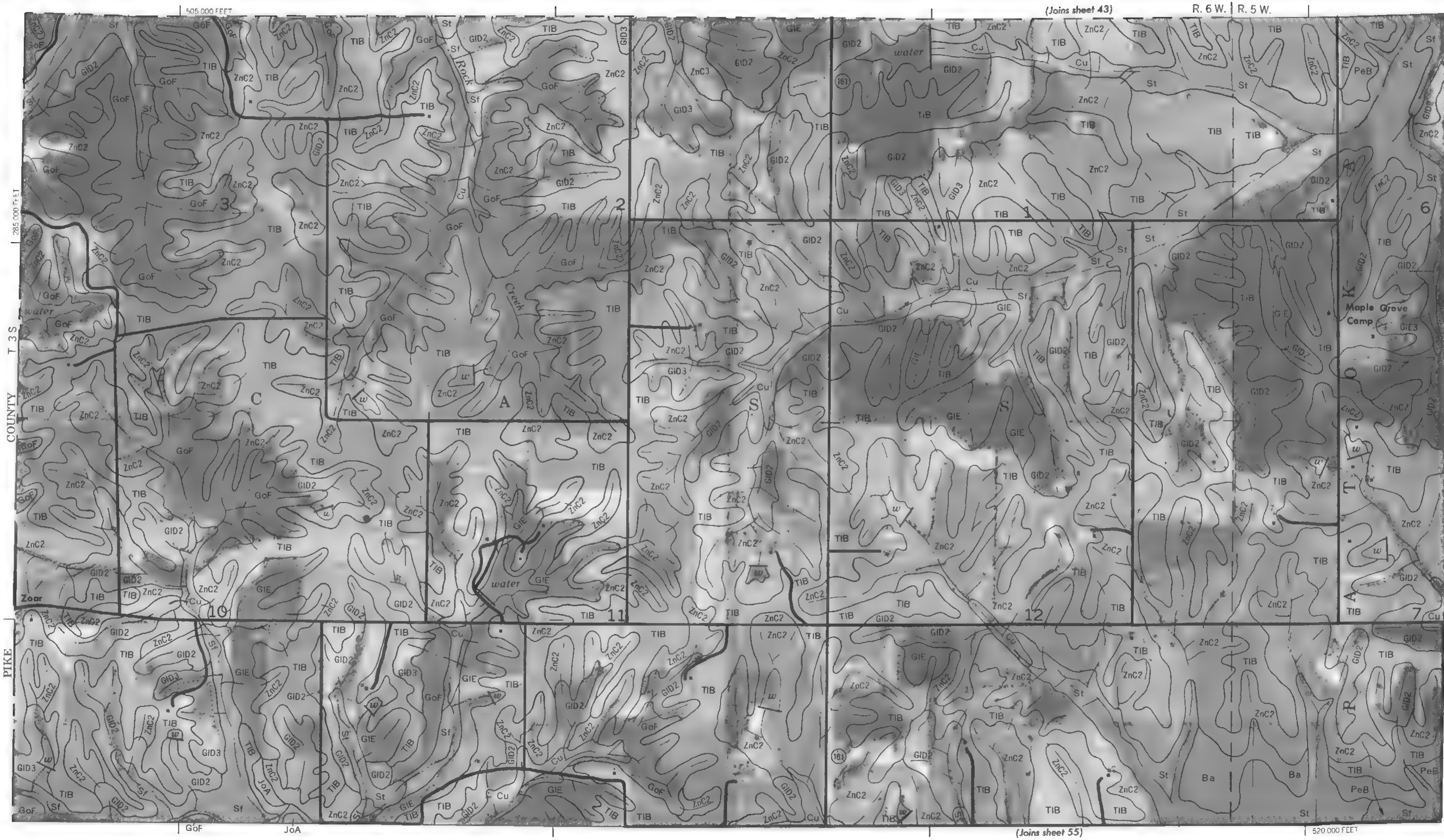
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



DUBOIS COUNTY, INDIANA NO. 47


48
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 42)
(Joins sheet 47)
(Joins sheet 53)
(Joins sheet 54)
R. 3 W.
T. 2 S.
Birdseye
HOOSIER NATIONAL FOREST
FERDINAND STATE FOREST
CRAWFORD COUNTY
J E F F E R S O N
Anderson River
Waddle Branch
28
27
26
25
33
34
35
36

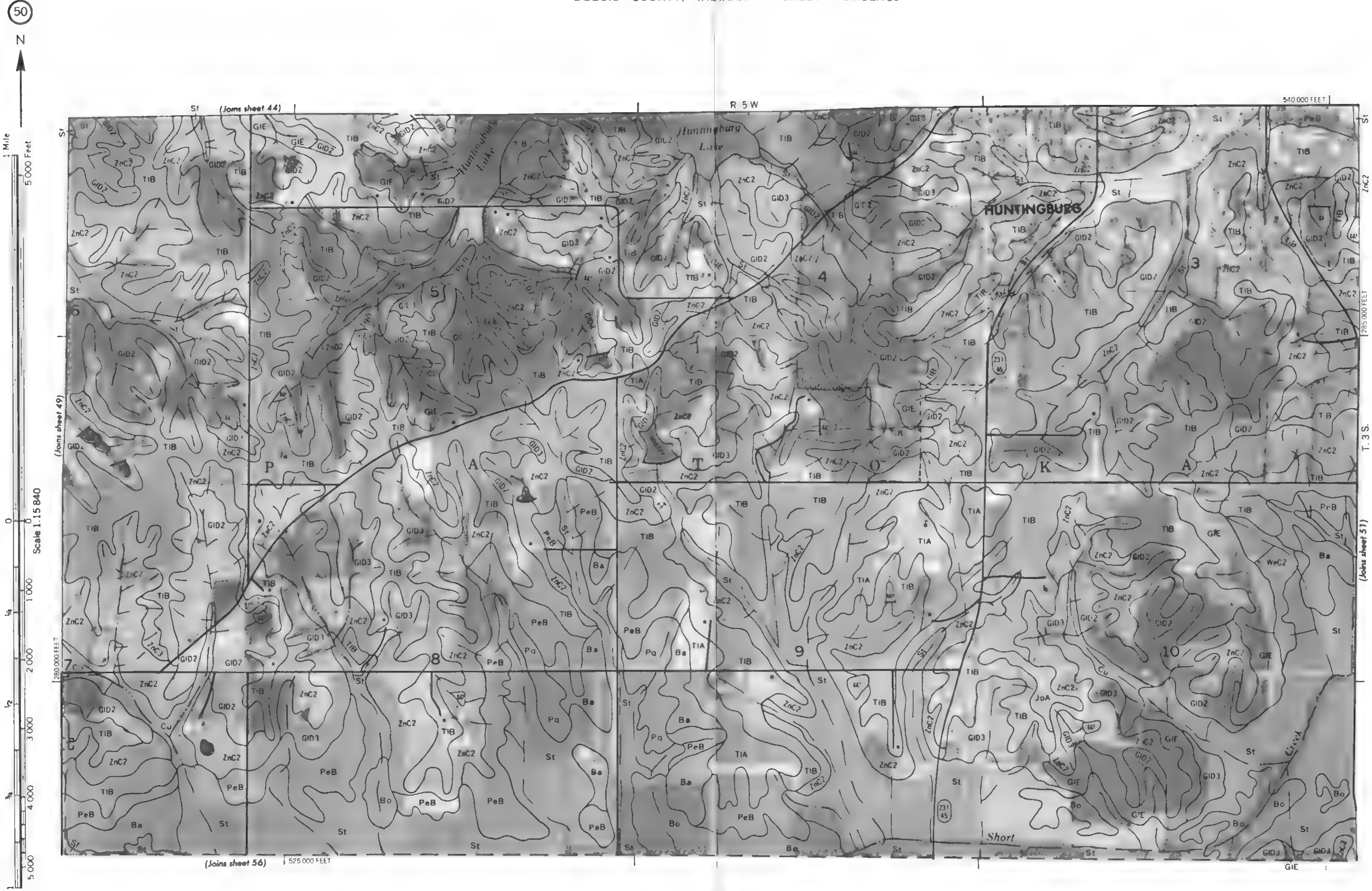
N

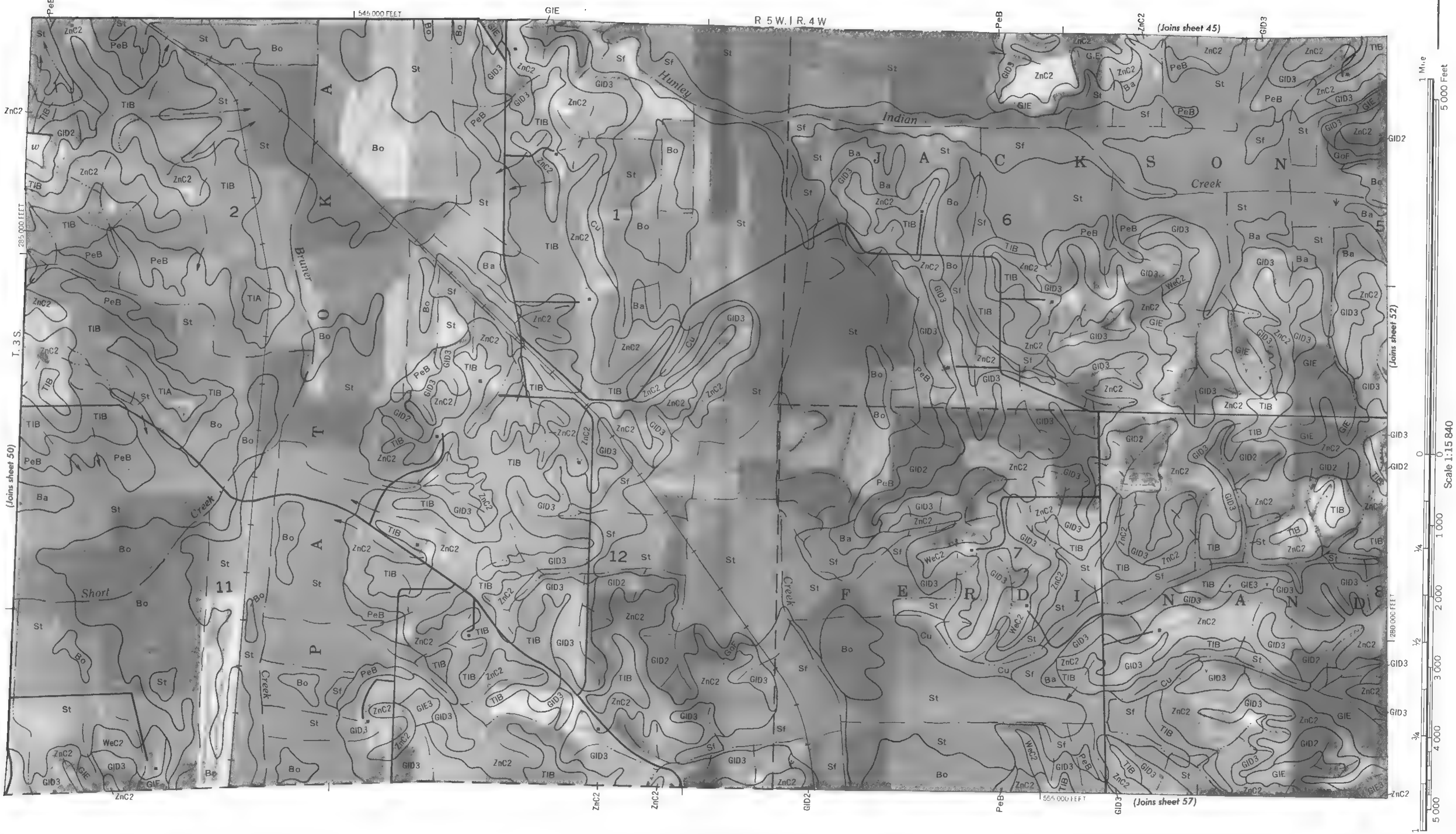


1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
0
1 000
2 000
3 000
4 000
5 000
Scale 1:15 840

DUBOIS COUNTY, INDIANA NO. 49

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


50
N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 44)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 56)
R 5 W
T. 3 S.
540 000 FEET
285 000 FEET
280 000 FEET
525 000 FEET
HUNTINGBURG
Huntingburg Lake
P A T O K A
Short
231
45



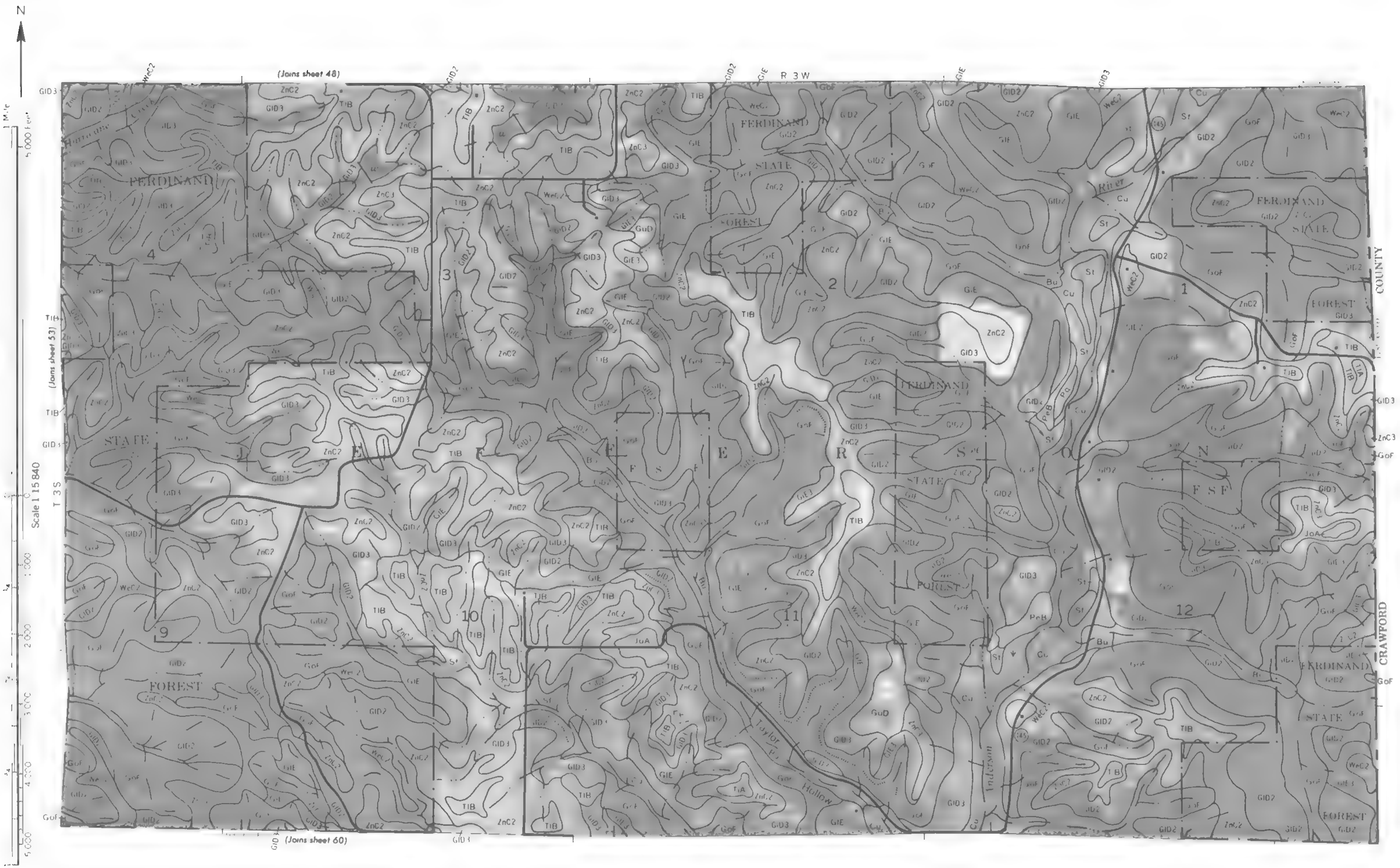
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

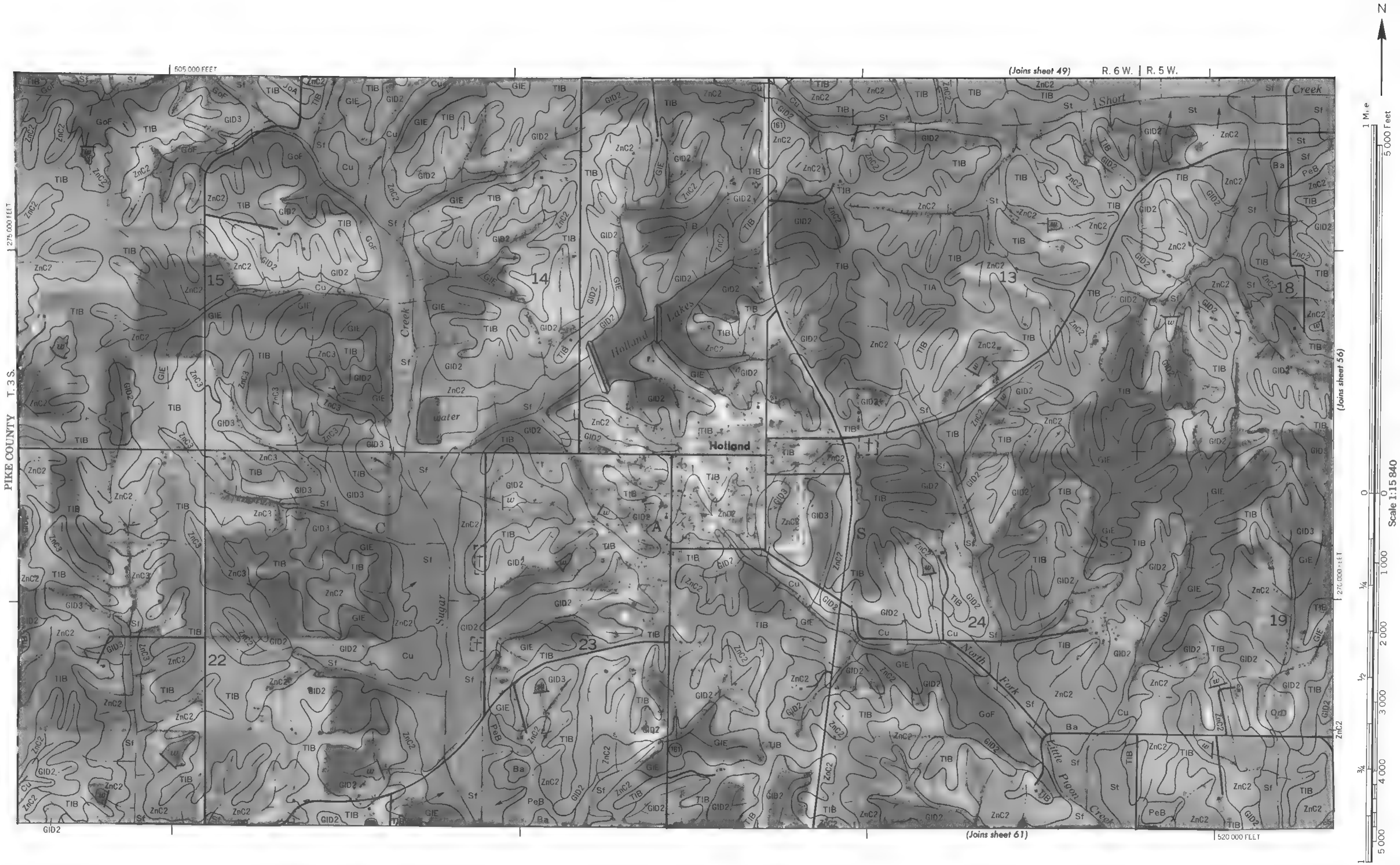

52
N
(Joins sheet 46)
(Joins sheet 51)
(Joins sheet 53)
(Joins sheet 58)
R 4 W
T 3 S
285 000 FEET
Indian Creek
Richland Creek
1 Mile
5 000 Feet
Scale 1:15 840

53

DUBOIS COUNTY, INDIANA NO. 53

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 48)
(Joins sheet 53)
(Joins sheet 60)
R 3 W
T 3 S
Scale 1:15 840
1 Mile
5 000 Feet
FERDINAND
STATE
FOREST
FERDINAND STATE FOREST
F E R D I N A N D
F S F
CRAWFORD
COUNTY
River
Taylor
Hollow
Anderson
1
2
3
4
9
10
11
12



DUBOIS COUNTY, INDIANA NO. 55

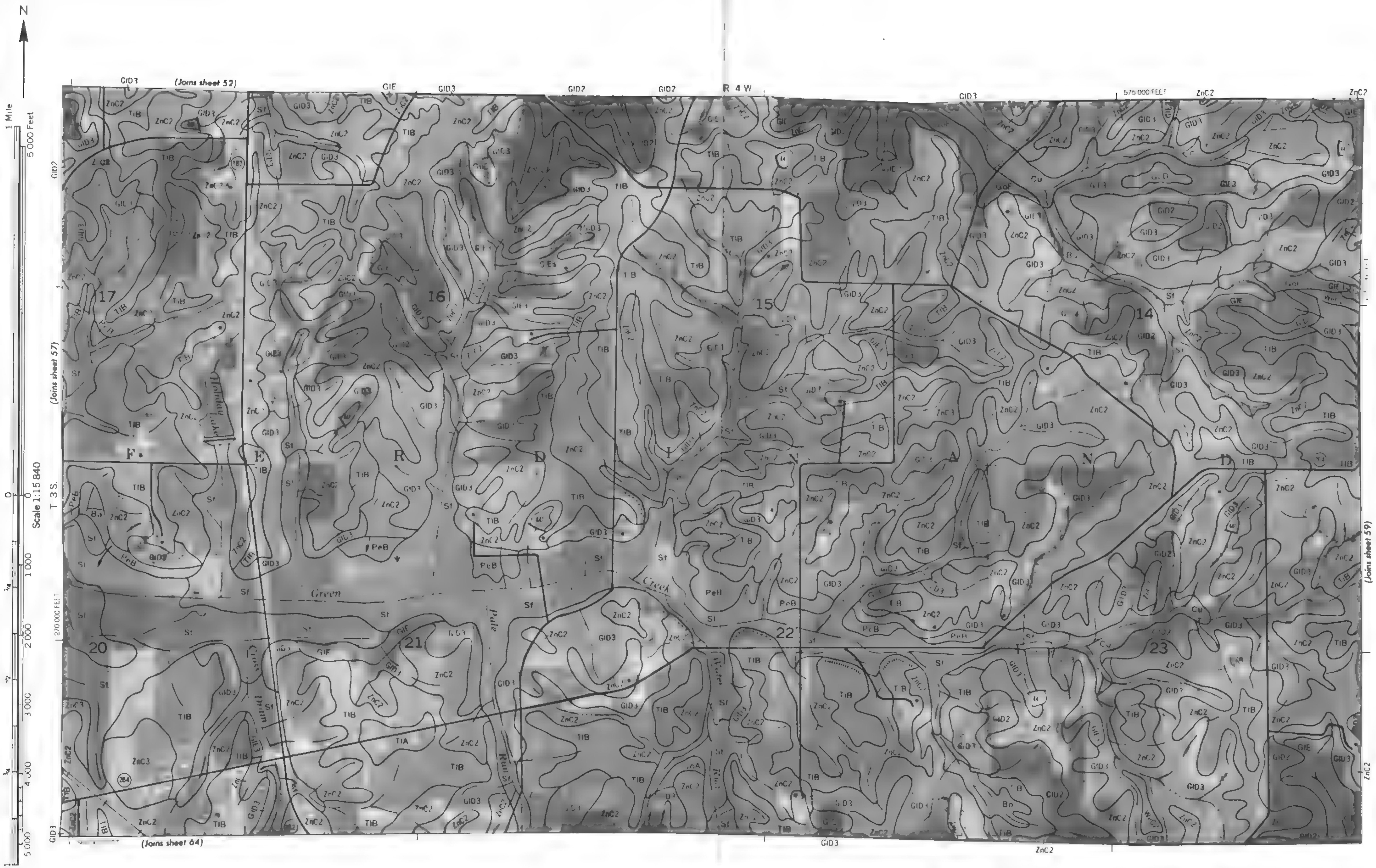
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

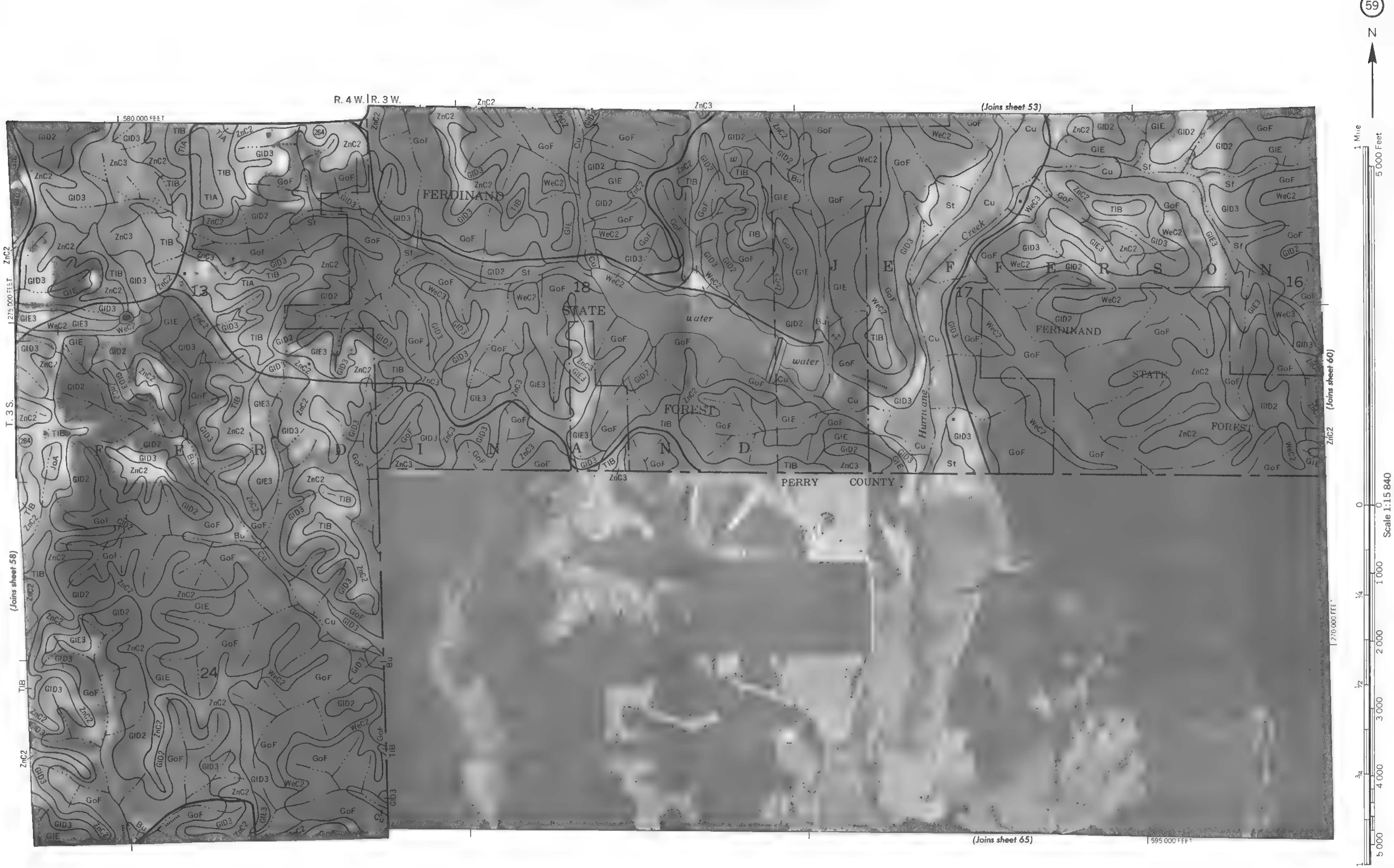
DUBOIS COUNTY, INDIANA — SHEET NUMBER 56

57

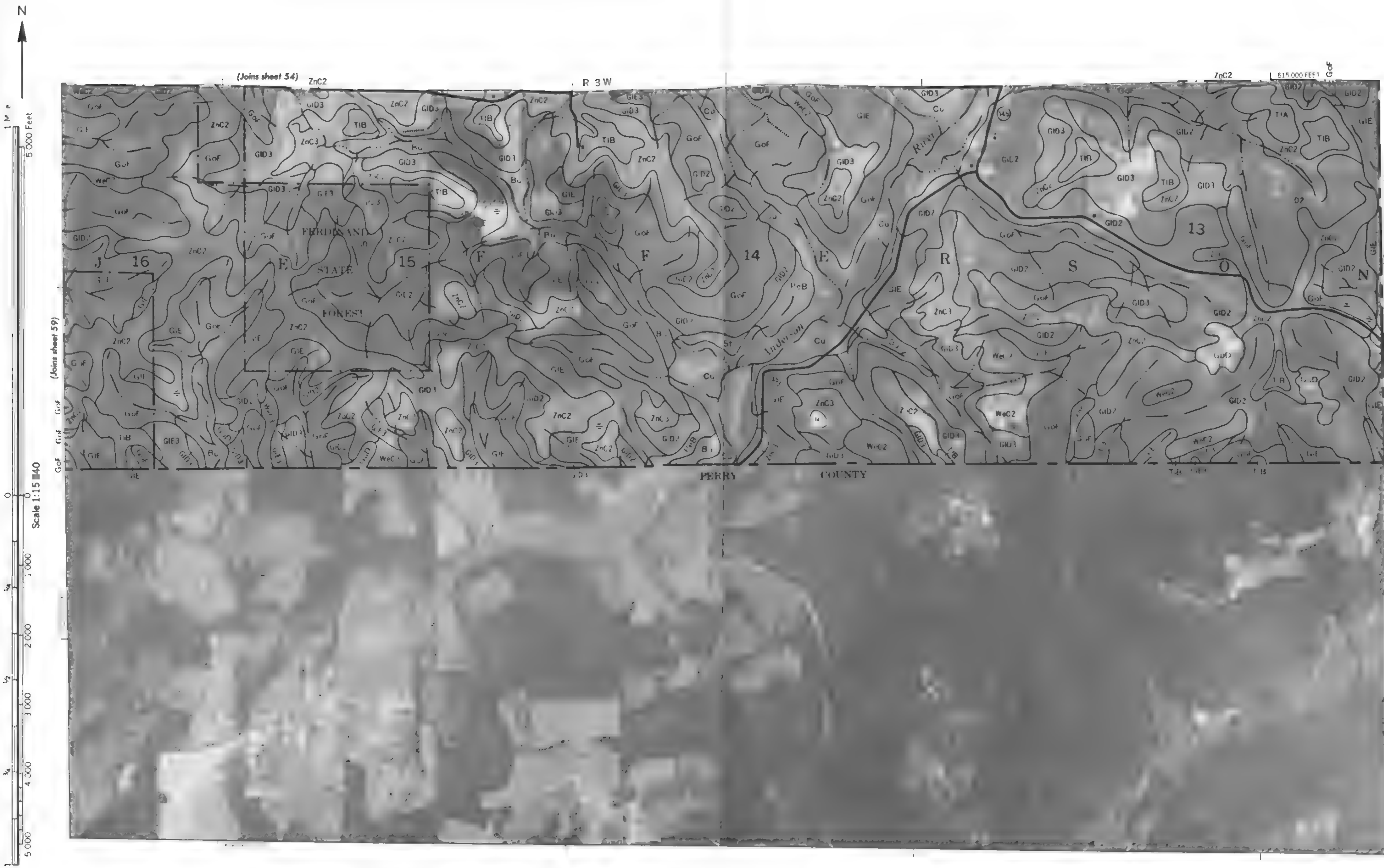
DUBOIS COUNTY, INDIANA NO. 57

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 Mile
5 000 Feet
Scale 1:15 840
0
1 000
2 000
3 000
4 000
5 000
(Joins sheet 52)
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 64)
R 4 W
T 3 S.
575 000 FEET
270 000 FEET
F E R D I N A N D
17
16
15
14
20
21
22
23
Holiday Lake
Green Creek
Cross Drain
Pole Run
162
264

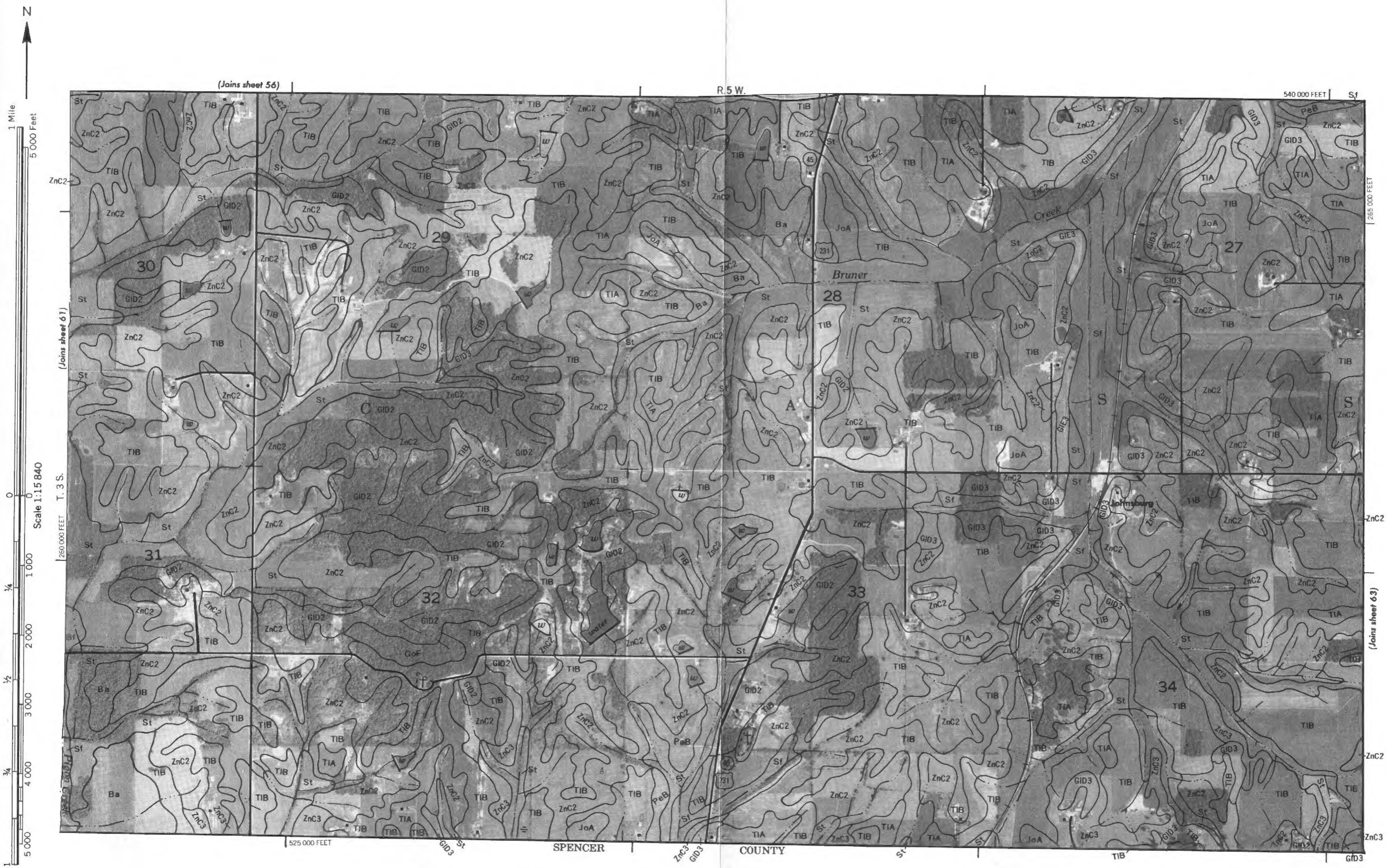


DUBOIS COUNTY, INDIANA NO. 59
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

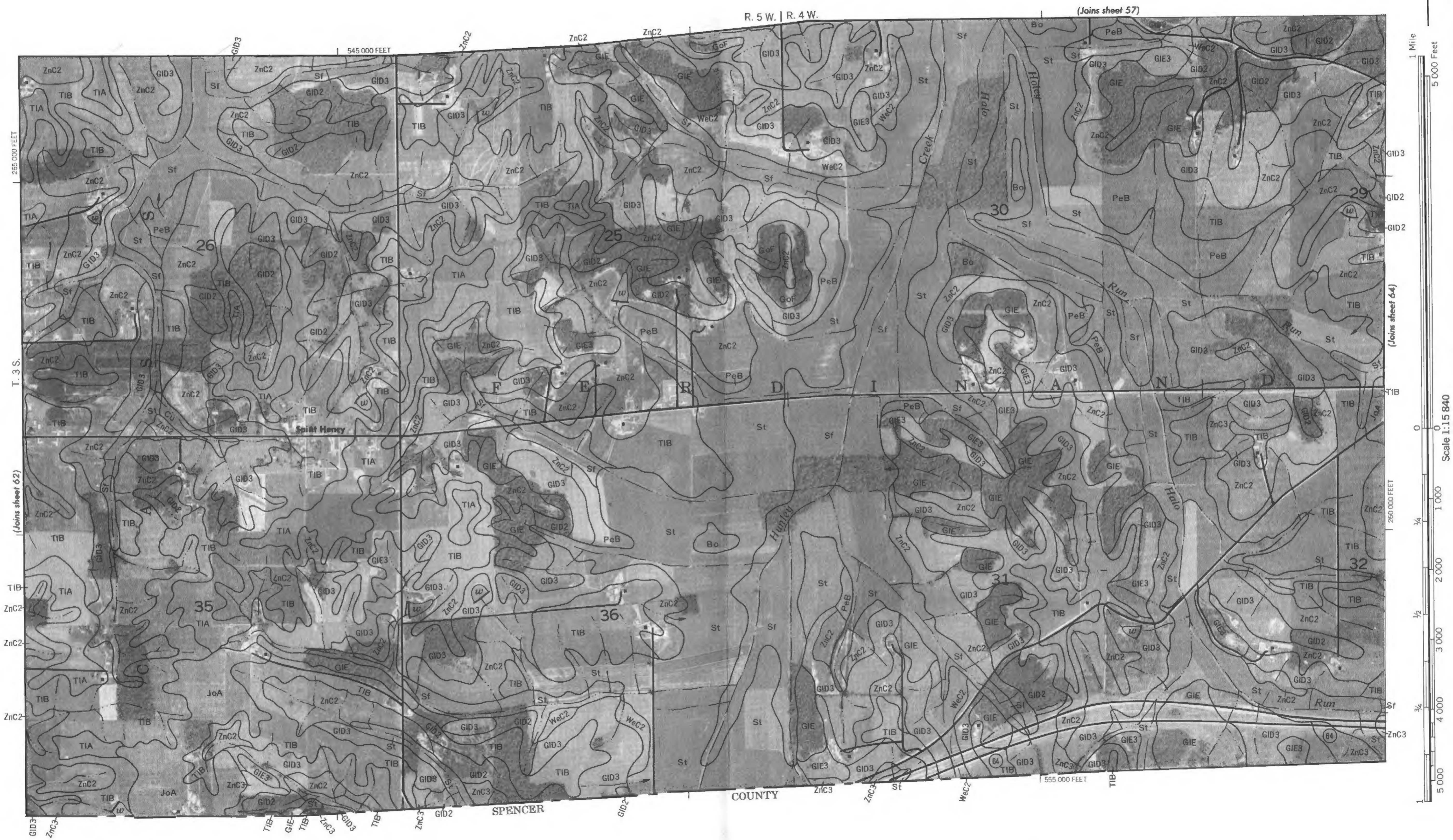

N
(Joins sheet 54)
(Joins sheet 59)
R 3 W
T 3 S
FERDINAND STATE FOREST
Anderson River
PERRY COUNTY
COUNTY
PERRY
16
15
14
13
Scale 1:15 840
5 000 Feet
1 Mile
615 000 FEET
75 000 FEET

DUBOIS COUNTY, INDIANA NO. 61

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
1 Mile
5 000 Feet
Scale 1:15 840
(Joins sheet 56)
R.5 W.
540 000 FEET
265 000 FEET
260 000 FEET
525 000 FEET
(Joins sheet 61)
(Joins sheet 63)
T. 3 S.
Bruner
Creek
Johnsburg
SPENCER
COUNTY
27
28
29
30
31
32
33
34

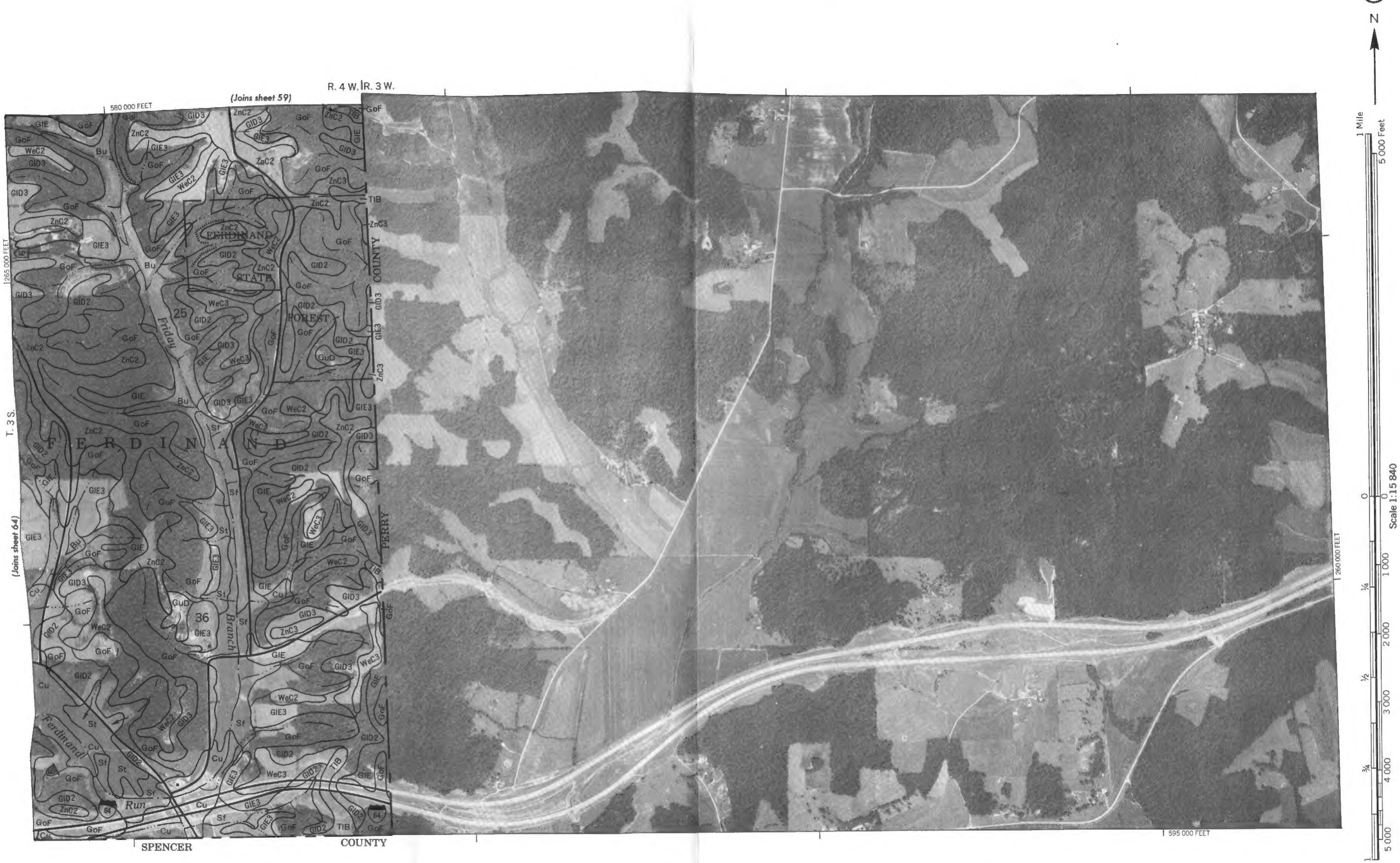
63



DUBOIS COUNTY, INDIANA NO. 63

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
(Joins sheet 58)
R. 4 W.
575 000 FEET
265 000 FEET
T. 3 S.
(Joins sheet 65)
(Joins sheet 63)
260 000 FEET
560 000 FEET
SPENCER COUNTY
FERDINAND
Holey Run
Water Run
Ferdinand Run
water
F E R D I N A N D
29
28
27
26
32
33
34
35
1 Mile
5 000 Feet
Scale 1:15 840



DUBOIS COUNTY, INDIANA NO. 65

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.